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Specification and Procurement

of Manufacturing Materials

Methods Employed at the Morrison Machine Company

By Frank J. Oliver, Jr.
Associate Editor, American Machinist

Material purchasing methods used in a typical shop employing about a hundred men and making a general line of machinery are described in this article, the fifth in the series. As in many shops of this size, several management functions are spread over a few individuals. Here the chief engineer is responsible for both production and purchasing. Only a few simple forms are used to control all the material purchases

IN A medium-sized plant such as the Morrison Machine Company, Paterson, N. J., several functions of management are spread over a few individuals. All purchases, for example, are made by authority of a man, bearing the title of chief engineer, who supervises both purchases and production. The president of the company is also the chief designer and as such makes the preliminary rough sketches for the guidance of the chief draftsman and his workers and determines the various materials that shall enter into the construction of each part. Considerable judgment on the part of the chief engineer is necessary, however, when the actual material orders are placed. Similarly, because of the small clerical force necessarily used, no complicated system of control or "red tape" is used in the purchase mechanism. Instead, some simple but effective means have been adopted, as will be explained later. The company makes high-grade textile finishing and dyeing machinery, mostly for use in the manufacture of silk goods, and also a line of speed reducers of a patented form. The plant is located in the heart of a city of 145,000 population and contains five floors, providing space for the various machine and assembly shops, stock room and office (on the top floor), drafting room and general office. About 100 men are employed normally. The shop falls somewhere between a job shop and a production shop, if one were to classify it, in that hardly any two textile machines are built exactly alike, but are assembled from standardized units or parts. In certain cases sub-assemblies can be used on more than one type of machine, so that some semblance of production can be obtained by manufacturing for parts stock.

As far as materials entering into the construction of these machines go, the customer has little interest as long as the machine does the work intended and lasts a reasonable length of time. From the company's point of view this means the best machine that can be built in competition with similar products. More often specific conditions dictate the choice of materials. For example, the use of Monel metal is necessitated in certain parts of dyeing machines because of the danger of corrosion. For the same reason, special stainless-steel ball bearings are called for in these machines. In another case, nickel tubing is used because it can be obtained seamless, whereas Monel metal (containing 67 per cent nickel) cannot. Aluminum is used in the construction of a particular winding reel for yarn because of its lightness—the unit has a long overhang on a shaft and the weight factor is therefore important. Then again, in the case of the speed reducers, it is simpler to cut similar pairs of gears throughout the train, but to vary the material from the low-torque to the high-torque ends. Low-carbon steel is therefore used for the former, and chrome-nickel steel for the latter. Ball bearings are used wherever possible in the construction of the machines on power-driven shafts and rolls, in line with

the policy of building the best machine possible with proper engineering economy. Certain types of ball bearings have been found suitable for specific locations and these are rigidly adhered to. The purchase of ball bearings is not divided among more than two of the bearing companies, and in no case has the customer specified his preferment, for the reason mentioned above.

Similarly in the case of electric motors and controllers, perhaps only one customer out of ten specifies the particular equipment by manufacturer's name, being satisfied merely to name his wiring conditions as to voltage, current and phase. The purchasing executive of the Morrison company, therefore, uses his own judgment and experience in the selection of motors. A few standard makes are supplied unless some chronic trouble is noted that would warrant a change to another type. In addition to the materials mentioned above, the company uses many others in the construction of its products. Considerable rubber is used for roll covering, and the rolls are covered by a nearby rubber company. Quantities of cypress are used, unfinished, for tank work; mahogany is used for built-up section rolls, and whitewood for certain trays. All this wood is purchased locally through about five suppliers. Quantities of wool felt paper are used for calendar rolls. Between 300 and 400 ft. of 20-in. steel pipe, and 100 ft. of 60-in. steel pipe is used in the course of a year, this material being bought on the basis of delivery and price.

Forgings are all bought outside from three or four sources and include both low- and high-carbon steel, as well as chrome-nickel, heat-treated steels occasionally. Castings of gray iron, semi-steel, malleable iron, brass, aluminum, Monel metal and gear bronze are all purchased outside the plant. About 30 to 40 tons of cast iron are consumed a month and seven sources of supply are used. Since a flat rate per pound is charged by local foundries, the selection of a particular foundry is largely a question of the class of work involved, the one shown by experience to excel in certain types of work being selected in each case. The question of delivery also enters in some cases, other conditions being equal. Strength is rarely a factor in this class of textile machinery and therefore semi-steel or malleable iron would be substituted for gray iron castings only where the parts are subjected to outside abuse. For instance, a projecting piece might be made of semi-steel to prevent its breakage either in shipment or against collision with a shop vehicle or a workman. About 1,000 lb. of brass castings are used a month; 2,000 lb. of gear bronzes; and 500 lb. of Monel metal castings. All gears are cut in the shop, helical gears being favored, with the exception of bevel gears which are obtained from several outside sources.

In most cases the requirements of the materials are not very exacting, aside from the fact that no facilities for testing are available, and hence elaborate specifications are not used. Cast iron is just cast iron, and chrome-nickel steel is ordered by the brand name corresponding to an S.A.E. analysis. Machinability, of course, as well as general appearance of castings show up very readily when the parts are put into production, and this is the chief check on quality of materials furnished. At present the company is expanding, and as production increases facilities for making elementary tests will be developed. The company holds an open-minded attitude toward new materials, particularly shop materials, such as tool bits, and is always willing to try out samples. Similarly, no salesman is turned away without the opportunity of telling his story. In the case of hobs, cutters, and drills, the purchase is limited to particular concerns whose product has met with uniform success in the Morrison shops. Similarly, paint, the only machine finishing product used, is purchased from one source, although other brands have been tried from time to time without measurable success.

Extractor

Drawing No's.		Pattern No.	Material	No. Req.	Notes
E-296	Assembly –	—	—	—	
E-297	Base	E-297	C.I.	1	
E-298	Basket	E-298	C.I.	1	
E-299	Brake Lever	E-299	Semi-Steel	1	
E-300	Brake Drum	E-300	C.I.	1	
E-301	Cross Joint for Toggle	E-301	C.I.	2	
E-320	Ring–	E-320	Bronze	1	
E-341	Toggle Joint	E-341	C.I.	1	
E-342	Toggle Joint	E-341	C.I.	2	
E-346	Cross Joint Stud for Toggle		C.R.S.	2	
E-347	Brake Adjusting Screw		C.R.S.	1	
E-348	Sleeve Coupling		Mach. Steel	1	

Fig. 1—All information regarding the parts and materials entering into the construction of semi-standard machines are conveniently listed on 4 x 6-in. cards

Raw and finished stock, together with all patterns, are stored on the top floor of the building. Just outside the storeroom the purchase executive and his two clerks are to be found in an inclosed office, and it is here that all purchase and shop orders originate. Both the patterns and the raw and finished castings are stored in racks having wire mesh bottoms so that any foundry sand will fall through to the floor. Bar stock is stored in a horizontal position, and all bins are numbered for easy reference. About $100,000 worth of material is held in stock, two-thirds of the value being in finished parts, and approximately $150,000 worth of patterns are maintained. For the material stock alone, a financial charge of about $500 a month is carried, based on an investment at 6 per cent—no mean item for a plant of this size—but it represents a compromise with production economy, and is therefore felt justified.

11-30-27

#1593

Atlas Dyeing Co.
Extractor

Special Material

Motor ordered Gen. Elec. Co. , A-365.
Starter " " " " A-365
Copper Basket ordered, Eagle Copper Co. ,A390.

Fig. 2 — Example of memoranda for ordering special material to complete a machine

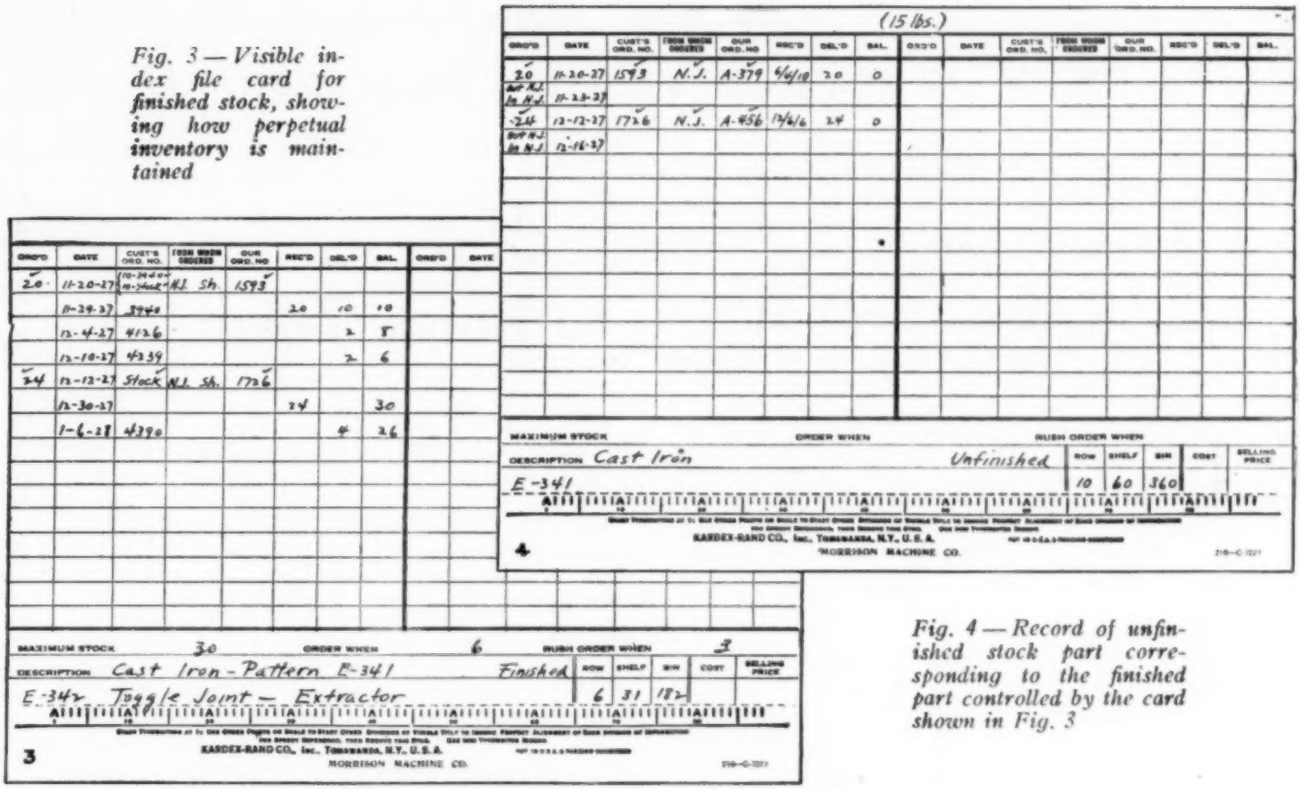


Fig. 3 — Visible index file card for finished stock, showing how perpetual inventory is maintained

Fig. 4 — Record of unfinished stock part corresponding to the finished part controlled by the card shown in Fig. 3

The greater financial part of the inventory is in finished parts, so that in the final analysis this carrying charge is assigned largely to service to customers from a delivery standpoint.

As was mentioned previously, nearly every machine built by the company differs from every other one in some details, but usually many of the units are standard. Hence there is maintained in the engineering department a complete list of standard and special parts for each particular unit. This information is tabulated on cards, such as the one shown in Fig. 1 for an extractor, and lists the drawing number, name, pattern number, material and number of each part required. When an order for a machine is received, all the parts lists are taken from file and sent to the chief engineer together with a typed list on a piece of plain white paper, 5x8 in., showing any special requirements of the customer, such as the extras listed on the typical sheet, Fig. 2. Orders are immediately placed with outside concerns for these parts, and the slip is retained for follow up.

The list of parts to be furnished by the Morrison shops is first checked against horizontal, visible index cards, such as the one shown in Fig. 3 for a finished part, on which a perpetual inventory is kept. These cards contain, besides a perpetual inventory and necessarily a history of receipt and delivery, a complete description of the part and data as to maximum and minimum stock quantities. Usually the minimum stock, below which an order for additional parts is initiated automatically, is sufficient to take care of all ordinary demand, so that it is only necessary for the clerk to note on a piece of scrap paper the quantity and bin location in the stockroom of each particular part. With the complete list thus prepared the stockroom attendant proceeds to obtain the parts from the shelves and place them together in a central position on the floor of the stockroom, from whence they go to the assembly floor below in accordance with the production schedule.

Hence it is obvious that in most cases, parts are made for stock against shop orders. In the example shown in Fig. 3, on Nov. 20, 1927, 20 finished parts were ordered, 10 of which were to be used on customer's order No. 3940 and 10 for stock on order No. 1593. Entries for subsequent delivery and withdrawal for particular customers' orders can be traced readily upon the card.

A similar visible index card, facing the one just described, is used to keep track of unfinished parts, and on the one shown in Fig. 4 the example cited above is carried through. It is noted that on the same date for the same shop order as shown in the first entry on Fig. 3, 20 castings were ordered from Foundry "N.J." The notation "Out N.J." and "In N.J." signifies in one case that the corresponding pattern was sent to the foundry on the first date and returned on the second, in this case three days later. The entry 6/4/10 in the column headed "Rec'd" is not the date, but signifies that the castings were received in three lots of six, four, and ten parts.

As seen on the finished part card, Fig. 3, when the stock balance fell to six parts, a stock order for 24 more was placed to bring the total up to the specified maximum of 30 as determined by experience. Colored indicators are placed on the control cards by the clerk to indicate order points to the purchasing executive. One other condition should be mentioned. The finished part number E-342 in the example does not correspond to the pattern number E-341 owing to some slight difference between the actual finished part and the one corresponding to the pattern number.

Some of the largest insurance companies are taking a new interest in air and other health conditions in industrial plants and public garages where thousands are employed. It is an actual fact, for example, that insurance companies have reduced fire and accident rates on plants where the risks have been lessened by provisions for air conditioning.

Rules—and When to Break Them

BILL HOLLAND was in the office of the Miller Pump Works, at the request of the manager, Phil Parker, to talk over some of the problems that confronted him. While there the representative of a well-known publication called, asking permission to talk to the foremen in the shop.

"I'm sorry, Mr. Blank, but it's against the rules to let anyone in the shop to see our men. I know your paper, and several of the boys take it. They tell me they get a lot out of it. But rules are rules, Mr. Blank, and I can't do it. If I let you in the shop I'd have to let in everyone who asked to go."

"I don't quite see that, Mr. Parker," said Blank. "You admit the men benefit by reading our paper —benefit you as well as themselves—and yet you class our paper with all others and won't let me show them something that will help them."

"But it's against the rules, Mr. Blank, and I can't make any exceptions. I'd like to let you in, but how could I explain it to men from other papers?"

"In the same way you do when you buy steel or anything else. You don't buy steel of every man who comes along just because you can't discriminate. You buy what seems best for your firm and tell the others the reason. It's about the same in our case, Mr. Parker. Many shops have similar rules, but they make an exception in a case like ours. And it isn't done any more to favor us than it is themselves, and they know it."

But Parker couldn't be budged, rules were rules to him, and that was the end of it.

"That young chap put up a pretty good argument, Bill," he said turning to Holland after the young man had gone. "But you can see that I just can't make any exceptions like that. They don't seem to realize that once you make rules you've just got to stick to them."

"I'm not so sure about that," replied Holland. "Personally, I think the young man had you licked to a frazzle when it came to reasons. This 'rules are rules' is a mighty sick argument to me— in many cases."

"But you've got to have rules, Bill. Can't get along without them."

"Of course you've got to have rules to handle the run of cases. But did you ever hear about the 'exception proving the rule'? If rules were all that were necessary to run a business you'd have a cinch. You have rules, or orders, about using certain kinds of stock in your pump parts. But if you get in a jam you substitute some other metal, just as good, or better, even when it costs more, so as to keep the work going. That's one of your exceptions.

"If rules would always run this business you could go to Florida in the winter and the Adirondacks in the summer, and have the dividend checks mailed to you. But you have to be on the job to see how things go and to side-step some rules or make new ones as occasion demands. Management is knowing when to bust the rules."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Preventing Unfair Rejections

The discussion in the office of the Milltown Products Company is typical of what happens in most plants after a rejection which seems unfair, but sometimes such a rejection is not as unfair as it seems. Isn't it possible that the company had been growing less careful with its product so that the rejected gears actually deserved to be rejected? Such a condition often develops when the customer has been lenient and has not been rejecting parts which were "almost up to specifications."

When a manufacturer sets a price for making an article to certain specifications, he has supposedly noted all the requirements and set the price accordingly. If he varies from the specifica-

tions and the articles are rejected, he has only himself to blame and has no reason to expect redress from the customer. The fact that parts which varied from the specifications had been previously accepted would not void the contract, or compel the customer to accept others. The only safeguard seems to be for both sides to make sure that a clear understanding exists as to exactly what is wanted. —C. J. MORRISON.

The "Can't-Be-Done" Man

The real trouble in this case is probably not so much the age of the men nor their experience, but their mental make-up.

When executives speak of their old employees, they usually mean men with great length of service with the company, and in one line of work. These faithful old employees deserve every consideration, but unfortunately they are often lacking in experience along other lines, and in addition, they are sometimes clannish, suspicious, and jealous of men who are younger in years, in ideas, and in length of service.

Baker and Jim are both to be congratulated that Jim has been given a free hand. Wholehearted co-operation, pooling of experiences gained by his assistants in other plants and branches, unbiased consideration of all constructive suggestions contributed by his force of workers, and good equipment, should all help to make the new plant a success.

—H. J. GUSTAV KOPSCH.

Overhead and Profits

When a man becomes so anxious for business that he is willing to forego a fair price, he becomes a menace to the trade. He cannot continue to do this without going bankrupt and causing others to lose their money. The deal of the Eastham Machine Company with the Wellington people is typical of profitless competition. Usually this kind of competition is caused by the futile efforts of out-of-date management trying to resuscitate a dying business.

Many managers and accountants do not seem to realize that methods and practices change with the times. Some of the old-timers, as well as some of the younger ones, seem to ignore the proper consideration of overhead and what constitutes it. All expense not listed as material and labor is overhead, even that relic of other days, the machine shop junk pile. The cost of all overhead must come out of the price received for the job, along with the labor and material charges, after which there must be left a sum remaining as a profit if the business is to remain healthy.

Overhead must include taxes, insurance, upkeep or repairs, depreciation, supervision, interest on the investment, and the costs of handling raw materials, semi-finished parts and finished product. Taxes and insurance are self evident, upkeep will make itself known. Supervision and handling costs can be held down to the proper amount. Interest on the investment can be determined from the book value. But depreciation must be governed by replacement prices. It is probably true that much of the equipment was not bought at the high prices of today, but it will have to be replaced at current prices when it wears out.

If the amount of depreciation is figured on the original cost of the machine and this cost is lower than the amount required to buy the machine today, the depreciation fund will not be large enough to permit of the replacement. In this case new capital must be found or the profit account called upon to make up the deficit. If new capital is called in more profits will have to be made or the dividend rate will be lowered. If the deficit is made up out of the profits the dividend rate will still suffer. Thus the only right way to insure a depreciation fund large enough for its purpose of replacing worn out equipment, is to rate the current depreciation on the current replacement values. These values will vary as prices go up or down. —L. O. BROWN.

Discontinuing Old Models of Machines

The problem presented is serious, but not at all unusual. I think it is not so much a matter of the faulty viewpoint of the customer, as a lack of foresight on the part of the manufacturer. In the first place, there should be no change in the model number unless there is sufficient improvement in design to furnish real talking points. If they are merely the minor changes incidental to keeping a model up to date the number should not be changed. The problem of replacement of parts can be handled through the serial number of the machine instead of the model number. This practice will lessen the sales resistance.

If, however, there is a distinct improvement in design, which provides real talking points, then it is proper to change the model designation. Descriptive literature, describing not so much the entire machine, as emphasizing the improvement, should be prepared, and distributed to all present users. Salesmen should be instructed to present the advantages of the new design to the old customers whenever opportunity offers, regardless of whether they are in the market or not.

With this missionary work properly handled, the old customer will be anxious for a new model when he is next in the market. He will have been sold on the advantages of the new model in advance, and will have no desire for another one of the old machines. In this way the old model can be discontinued in a reasonable time after the announcement of the new, and without complications. —BERNARD MCCORMACK.

Tungsten-Carbide Tool Efficiency

By GEORGE S. BRADY
Associate Editor, American Machinist

ENDURANCE tests of tungsten-carbide cutting tools, run at the Philadelphia Navy Yard, demonstrated that this material when operated under proper working conditions, and for the purposes intended, will cut hard and tough steels at higher speeds than have ever been attained by high-speed steels, and that when working at high speeds without overtaxing the tools the latter will stand up indefinitely without resharpening, thus making great savings in grinding and set-up time.

The major trial was a break-down test of a Carboloy roughing tool working on a regular turning job on 3½-per cent nickel steel containing 0.020 carbon. The

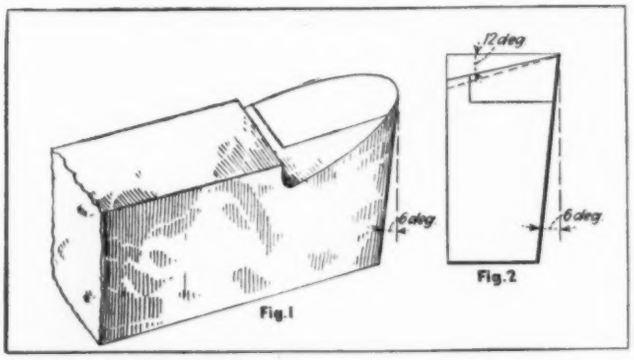


Fig. 1—Roughing tool used for the test. Fig. 2—End view of tool showing rake and clearance angles. The tool was set on dead center

tool is shown in the illustration, and was set up in a double-strap type of toolholder on a 48-in. heavy-duty lathe driven by a 25-hp. motor. The lathe was an old one, regularly employed on this class of turning. The steel forging being turned was approximately 20 in. in diameter, and was clamped on the chucking end in a special fixture on a face plate, thus bringing it closer to the spindle bearing than is possible with the ordinary chuck.

The test was planned and conducted entirely by Navy engineers. Its objects were: (1) To determine the saving in grinding time of tungsten-carbide tools over high-speed tools when run at the maximum economic speed of high-speed tools. (2) To determine if the power consumption increased perceptably under long cuts with tungsten-carbide tools. (3) To determine, finally, the ultimate possibilities of the tungsten-carbide tool.

The machine was set for turning the forging as under the standard feed and speed employed for high-speed steel roughing tools. The cutting speed was set at 56 ft. per min., with a 0.044-in. feed, and $\frac{3}{16}$-in. depth of cut. The usual practice of the shop with this cut was to sharpen and reset the high-speed tool every 10 to 20 min. The Carboloy tool was run for 3 hours with no stops except to run back the carriage and start a new cut. No sharpening nor honing of the cutting tool was done during the 3-hour period, and the edge was in excellent cutting condition at the end of the run.

The electric meter readings at the beginning of the test showed 228 volts and 29 amperes, or the same as for high-speed steel tools, and the readings did not increase during the run. The test showed that no greater power is required than is required initially for high-speed tools, whereas the high-speed tool takes an increasing power consumption due to the gradual dulling. It also indicated that when operating at normal high-speed steel cutting speeds the tungsten-carbide tool life is indefinite.

The machine was then speeded up to 90 ft. per min., or an increase of about 65 per cent over the best shop results with high-speed tools. The feed and depth of cut were kept as before, and the same steel forging was cut. The Carboloy tool used in the previous test was used without resharpening.

This second stage of the test was continued for 77 minutes with no grinding or honing of the tool. No lubricant or coolants were used on the tool, and the chips broke in small lengths with slight curl. The tool did not become red hot as it appeared to be amply large to carry off the heat, but the chips were purple and sparks were intermittent. The initial readings on the power line gave 224 volts and 35 amperes. After about an hour of running the current consumption was raised to 37 amperes, but this slight increase was not conclusive evidence of increased power requirements for the tool since it could also be accounted for by increased consumption in the machine itself from heating of the bearings and tailstock center. However, the top of the tool at the end of the test showed craters abraded by the chips. It was apparent that this cutting speed could be considered as an economic operating one, giving high efficiency in time saving and in grinding over the high speed tools for this class of work.

The cutting speed was next stepped up to 115 ft. per min. in order to run a "break-down" test of the tool. The same tool was used without resharpening, and the same feed and depth of cut were employed. The current consumption readings showed an average of 47 amperes required for this cut. The tool end was red hot under the cut directly behind the cutting point. At the end of 20 minutes operation the tool was examined. It showed a deep crater made by the abrasion of the chips, but as the power consumption had not increased preceptably it was assumed that this wearing away on the top of the tool has a "self-sharpening" effect.

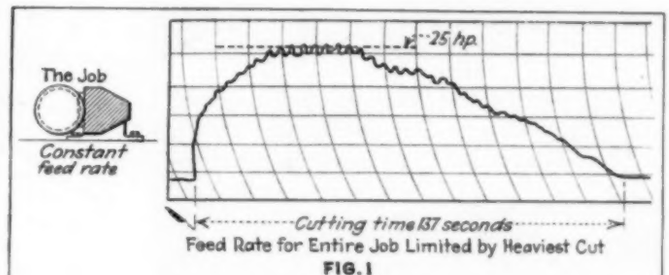
As it was apparent that this speed was not going to "break down" the tool before the end of the day's test, the speed was brought up to 190 ft. per min. and the feed up to 0.062 in. The same tool was used without resharpening. The same depth of cut was maintained. Under this cut the front of the tool abraded so badly before 2 in. of the length of the forging was cut that it was apparent that this speed and feed was too severe for the tool on this class of steel, and the economic speed was below this point.

Performance Records *of* Hydraulic-Feed Milling Machines

By Frederick B. Heitkamp

Assistant Sales Manager,
Cincinnati Milling Machine Company

NOW that machine tools equipped with hydraulic feed have had a thorough trial in the service of users it is worth while to consider the results secured and appraise their value. Something more than a year ago the Cincinnati Milling Machine Company introduced a machine with locked hydraulic feed and called it the Hydromatic. Some performance figures on this machine form the basis for what follows and indicate the possibilities inherent in the hydraulic feed. The locked hydraulic feed differs from conventional systems of hydraulic feed for machine tools in that the piston which moves the table is at all times under heavy pressure from both sides, the desired feed rate being determined by the amount of oil permitted to escape under pressure from the discharge end by way of the variable displacement pump. In this way a high back pressure is always acting to resist the movement of the piston, and consequently the table is locked and properly controlled in its movement. One of the savings which can be traced largely to the hydraulic feed has been a decided increase in cutter life. In the application of hydraulic broaches, drilling machines and other machine tools, one of the most outstanding results noticed was a decided increase in the life of the tool. Exactly the same effect has been found to exist in the case of the hydraulic-feed milling machine. These increases of cutter life have varied all the way from 30 to 300 per cent.



Feed Rate for Entire Job Limited by Heaviest Cut
FIG. 1

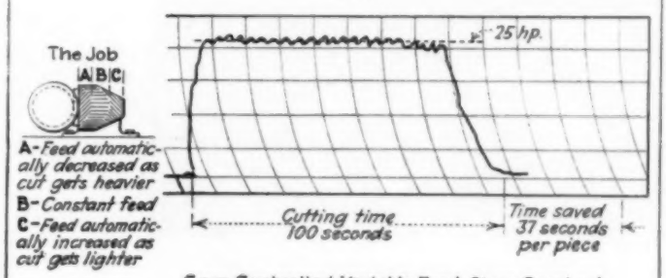
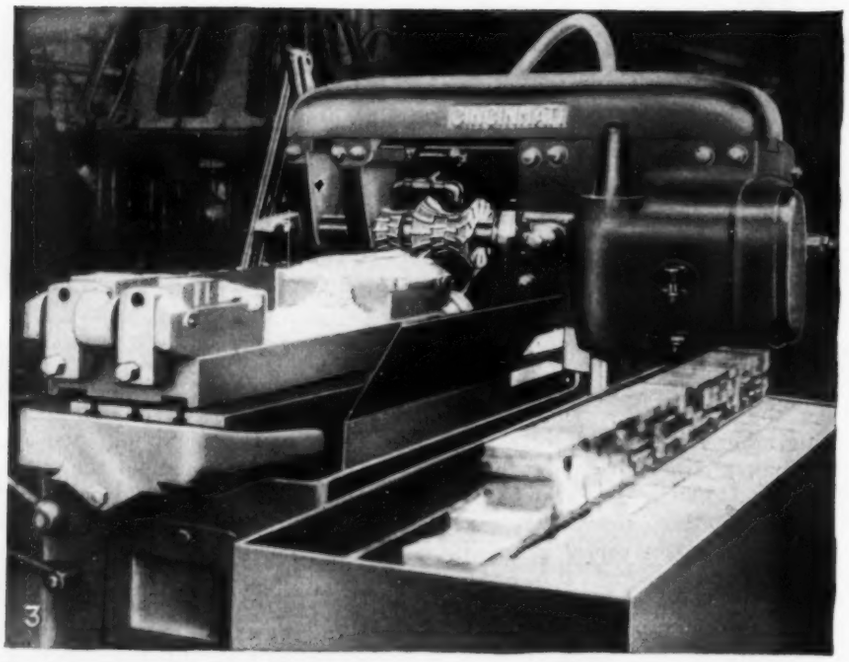

The Job
A B C
A-Feed automatically decreased as cut gets heavier
B-Constant feed
C-Feed automatically increased as cut gets lighter
25 hp.
Cutting time 100 seconds
Time saved 37 seconds per piece
Cam Controlled Variable Feed Gives Constant Metal Removal for Entire Job
FIG. 2

Fig. 1—Power chart of milling operation with constant feed. Fig. 2—Power chart of the same operation with automatically variable feed. The saving in time is appreciable

There has likewise been a decided increase in the efficiency of metal removal. The extent of the improvement, of course, is affected by a great variety of factors and will vary with every job. One cost factor in milling is that of power consumed, and the reduction made possible through this higher efficiency further reduces the cost of milling.

The hydraulic-feed feature has made possible the use of variable feed under cuts. In Fig. 1 is a curve which represents the power consumed on the job pictured. This test was taken on a screw-feed machine with the table feeding at a constant rate. It is clear that here the machine is operating at full capacity for only a brief period of time. Contrast Fig. 2 showing a curve of a hydraulically-operated machine. This curve indicates a rapid increase of power up to the maximum and the maintenance of efficient operation throughout the entire cut. The time to take the cut with the hydraulic-feed machine is much less than with the mechanical feed and yet at no point is the machine overloaded. Another innovation brought about through the use of the hydraulic feed is the accuracy of trip. Owing to the fact that no clutches or similar devices are employed, the tripping from the feed rate to the rapid traverse, or vice versa, is very accurate. Furthermore, the use of a positive stop has been made possible. With this feature the operator may feed to a definite depth and pause momentarily to clean up the cut, thus milling to a fixed limit with unusually close accuracy. The feed rate can be changed automatically during the cut as the section of the cut varies, thus keeping the machine constantly up to the maximum metal removal. Table movement being controlled automatically by dogs, practically any milling cycle can be obtained. Definite production figures from leading manufacturers are cited in the performance facts which are here given. In each instance the figures represent decided improvements over previous production obtained, but it must be understood that each job has its own peculiarities. Consequently, it is not always possible to compare what may appear to be a similar job with the ones here shown.

In Fig. 3 a plain hydromatic machine is milling, from a rectangle of a cold-rolled steel, the crankshaft counterweight for a straight eight automobile. Cutters consist of special form mills and revolve at 23 r.p.m. Fixtures are mounted on the ends of a 20x36-in. index base which is clamped to the machine table. One complete set of counterweights is clamped in each fixture; four small ones and four large. The pieces are set in the fixture against two hardened guides. They are secured against stops on the flat side by two clamps at the front of the fixture. Not only was production increased 90 per cent



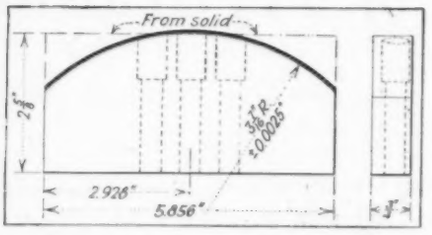


Fig. 3 — Crankshaft counterweight form—Milled from the solid. Production increased 90 per cent to 216 pieces per hour

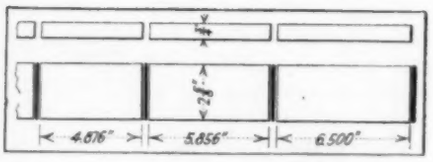
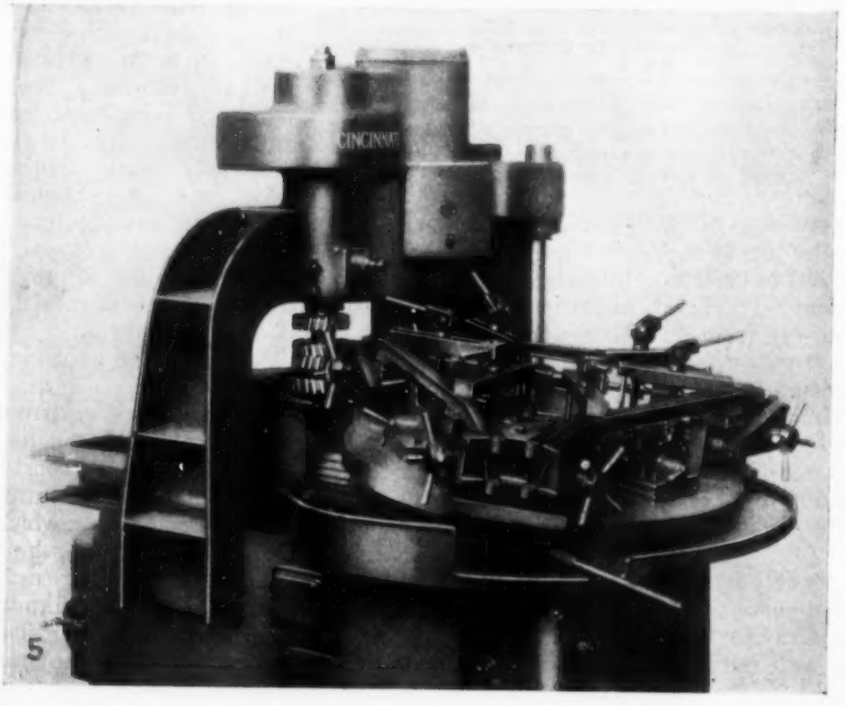


Fig. 4—Sawing crankshaft counterweights from cold-rolled bar stock. Cutter speed—27 r.p.m. Feed—3½ in. per min. Production—475 pieces per hour



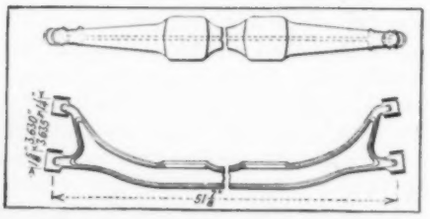


Fig. 5—Straddle-milling forged axle knuckles at the rate of 58 pieces per hour. The rate could be increased if the operator could load and unload faster

but labor costs were lowered, the machine proved to be easier to operate, handling time was lowered, work spoilage reduced and upkeep cost materially decreased. Production on this job amounted to 216 pieces or 32 complete sets per hour.

A companion operation to be found on another machine in the same plant is shown in Fig. 4. Here the crankshaft counterweights are being sawed off from cold-rolled steel bar stock. Four pieces are held in the special air-clamped fixture by individual clamps acting upon each section being milled. These pieces are fed against a stop, which is raised by hand into position by the operator and which automatically depresses when the cutters advance to the cut, permitting the large inserted tooth side mill to face the ends of the bars. A special bridge-type brace gives additional support to the large gang of cutters. A companion fixture is mounted on the other end of the table and four pieces are cut from each bar, thereby making it possible to obtain eight counterweights, or a complete set at each cycle. The hydraulic feed is advantageous on a sawing operation of this kind because of the cushioning effect which it provides. Decidedly longer cutter life was recorded. The cutters consist of four 10-in. diameter saws and one side milling cutter mounted on a No. 2 B 30-5 arbor. Cutters revolve at 27 r.p.m. The feed is 3½ in. per min., and the time per cut is 1.1 min. Production is 475 pieces or 60 complete sets per hour.

Great Variety of Combinations

Hydromatic milling machines are built as standard plain or duplex machines, and with varying table widths and bed lengths. They are constructed on the unit principle and a great variety of different combinations can be supplied to the user who can select the right one to fit his production requirements, largely from standard units.

In the next illustration, Fig. 5, standard units have been used throughout with the exception of a vertical spindle carrier and arbor support as indicated. The operation is that of straddle-milling steel forged knuckles on a front axle of a popular automobile. Fifty-eight pieces are produced per hour. This output could be materially increased so far as the capacity of the machine is concerned if it were not for the fact that the limiting factor in production is the operator's ability to load and unload the work. A special vertical spindle is mounted upon the standard upright, supported at the left by a rigid brace fastened to the bed of the machine. A special three-position hand-indexing fixture, revolving on ball bearings, holds three axles which are already bent to their final shape, and which are arranged about an equilateral triangle. The work is clamped on spring pads on two fixed supports. Equalizing stops are provided on the fixture for end location.

The top table of the index fixture is tilted and each piece is rolled over a slight amount so that the work is held at the proper double angle to bring the two bosses toward the cutter in a plane parallel to the table. The work feeds straight in to a gang of cutters which are mounted on a special heavy vertical spindle carrier, each time finishing one set of bosses on two pieces, or one complete piece per pass.

Longer cutter life has been obtained on this operation than when it was handled on a screw-feed type of machine. The long bed structure makes it possible to get unusually rigid support for the entire indexing mechanism.

Another example is shown in Fig. 6 where production was increased 53 per cent. Perhaps the most significant saving, however, was the fact that 50 per cent more pieces of work were obtained per cutter grind. This machine replaced knee-and-column-type millers and now mills the cast iron impeller form in one cut giving the required finish, instead of one rough and one finishing cut as previously handled.

From ⅛ to $\frac{3}{16}$ in. of stock is removed on this impeller by the large form cutters shown. The parts are held in two fixtures mounted upon the machine table. The particular operation shown requires only one spindle, but the user installed a duplex machine in order to take care of a wide variety of other work. This is a real form milling job, with a cutter contact of about 14 in. In

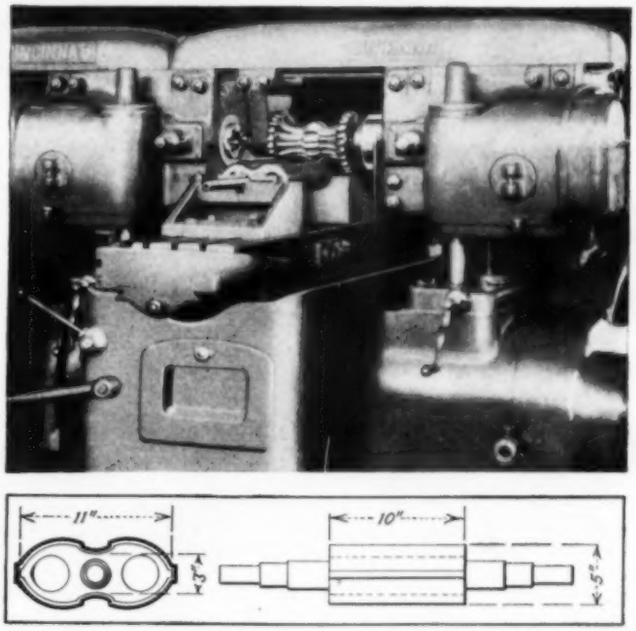


Fig. 6—Form-milling a large impeller. Production was increased 53 per cent to 6 pieces per hour, and cutter life between grinds 50 per cent

producing a machine of this character it is realized that the powerful hydraulic feed must have an unusually rugged machine to back it up. Consequently the drive from the pulley to the cutter is made of unusually large proportions, is entirely anti-friction, and there are but four gear contacts in the entire spindle drive.

The cutter is a form mill 10 in. in diameter, 14 in. long, mounted on a 2-in. arbor, and revolving at 37 r.p.m. The feed is 3½ in. per minute, and the time per piece is 8.7 min., or a production of six pieces per hour. The possible production on this machine is limited by the finish required on the work. The machine is capable of giving much higher output.

The operation of Fig. 7 is milling the top surfaces and edges of a forged steel mower-knife head. The pieces are held in special fixtures mounted on each end of a standard 16x30-in. index base. Each piece of work rests on two fixed and two equalizing supports, and is clamped over the top by a forked, hinged clamp controlled by a pilot wheel.

Because the pieces are very difficult to hold, the cutters have a tendency to lift up on the work. Consequently, it is necessary on a job such as this to start in at a slow feed, wait until the cutters have entered the work a satisfactory distance, and then increase the feed during

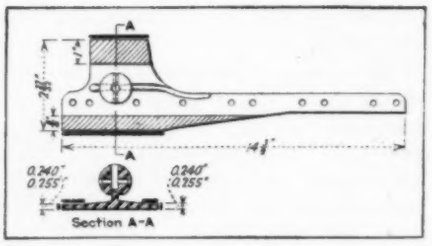
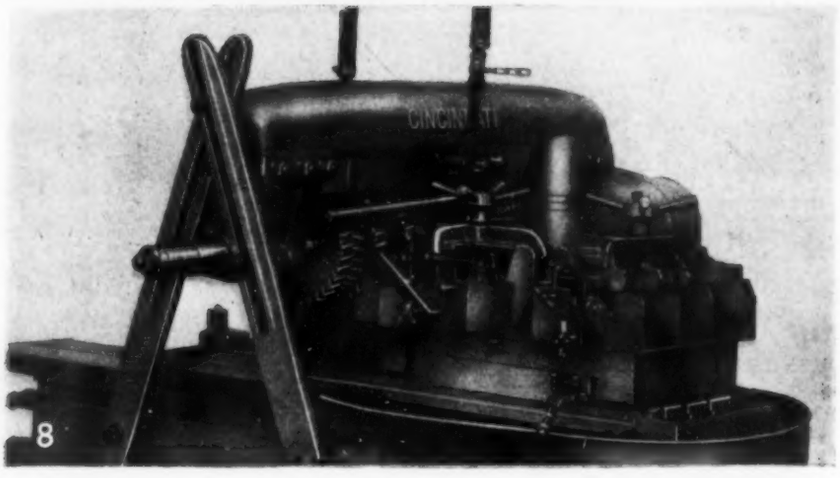


Fig. 7 — A feed varying from 1 to 10 in. per min. is used to mill these mower-knife heads. It would have been exceedingly difficult to do this job on a constant-feed machine



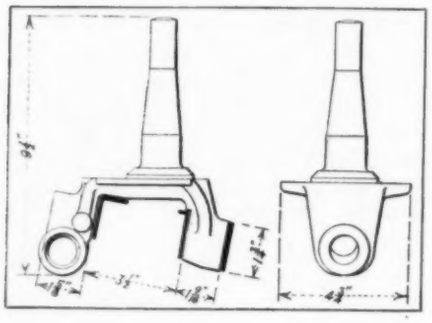
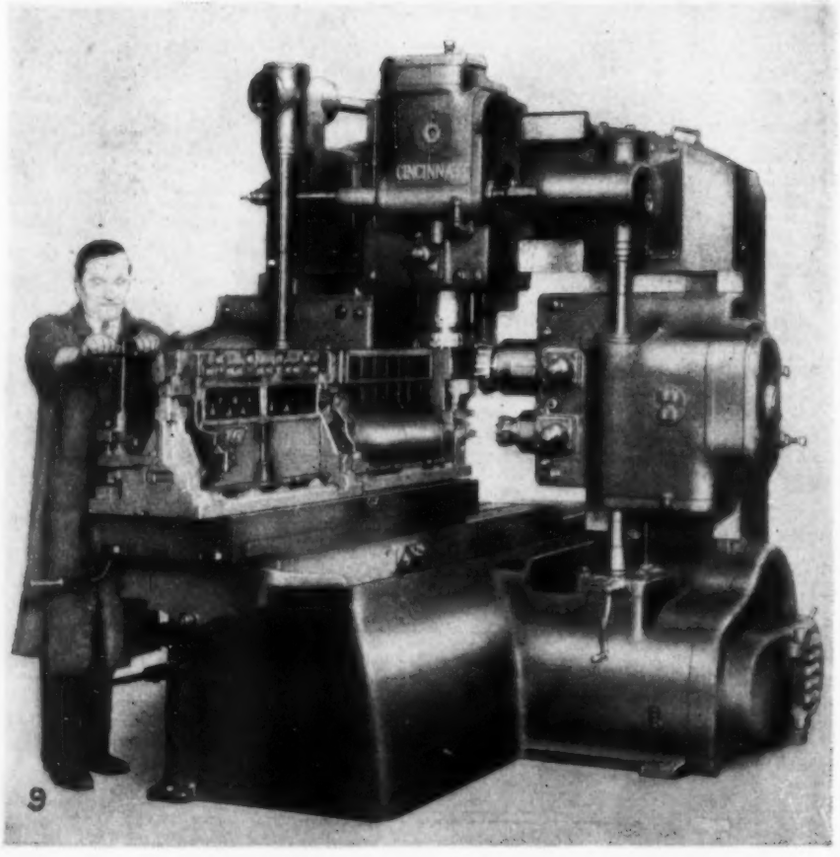


Fig. 8—Cutter life was increased 160 per cent when hydraulic feed was applied on this steering knuckle job. One hydraulic machine replaced two standard machines



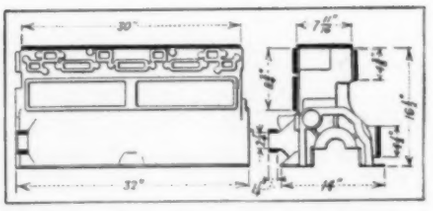


Fig. 9—On these cylinders the actual cutting time is 93 per cent of the cycle. The index base method of milling cylinders is new

the cut. The hydraulic mechanism makes it possible to do this automatically, and therefore very materially increases production. The feed is actually varied from 1 in. to 10¼ in. per min. 1/16 in. to ⅛ in. stock is removed.

Another interesting feature is the large cutter gang, consisting of cutters 6⅝ in. and 7¼ in. in diameter, mounted on a 2-in. arbor. The cutters revolve at the rate of 63 r.p.m. Production per hour is 193 pieces.

In milling tough forged-steel steering knuckles on the job shown in Fig. 8, the faces of three bosses are machined, and there is an additional cut at the bottom of the piece. One left- and one right-hand knuckle are mounted on each end of a 16x30-in. index base. Two

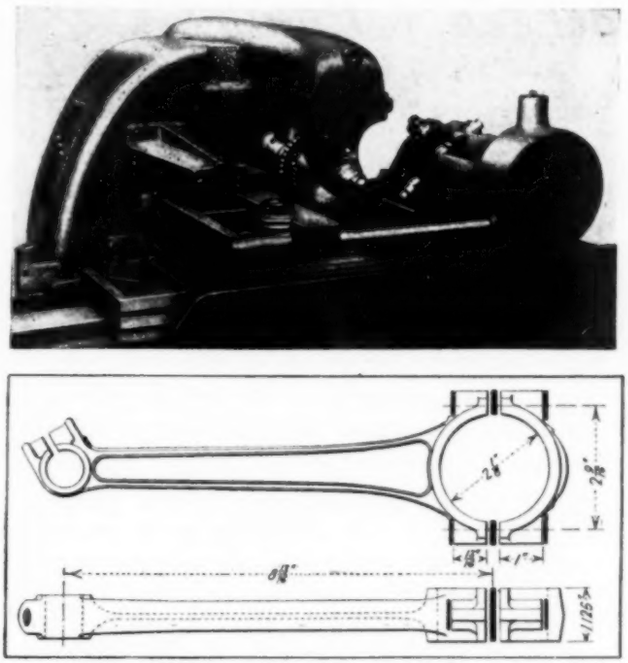


Fig. 10—Splitting and straddle-milling conecting rods at a rate of 140 to 200 rods per hour. The operation is automatic except for loading and unloading

pieces are held abreast in each of the fixtures. Obviously, it is possible to take a faster feed at the beginning of the job where the three bosses are being milled, but when the cutter digs into the end of the piece, additional metal removal is necessary and it is essential that the cut should be slowed down. The job was taken from two other machines previously used. The Hydromatic turns out the work just about twice as fast. Cutter life is increased 160 per cent. More pieces are obtained per grind, less time is taken out for changing cutters, there is lower cutter cost and more satisfactory work and more production result.

New Way of Milling Cylinders

On the job shown in Fig. 9 variable feed saved 35 per cent in production time. In milling the cast iron cylinder blocks, a standard Hydromatic machine was used with special horizontal and vertical spindle carriers. The operation is that of milling top, large side pad, manifold face, tappet cover face, and right and left support pads. ⅛ in. of stock was removed. The cutters consist of one 9-in. diameter inserted-blade stellite face mill, one 10-in. diameter inserted-blade stellite face mill, two 8-in. diameter H.S.S. half side mills, and one 5-in. diameter inserted-blade stellite shell end mill. The operator unloads and loads one end of the index base while the cylinder block on the other end is being milled—reducing the machine cycle to four elements:

1. Rapid advance to cut;
2. Mill with the variable feed automatically controlled;
3. Rapid return automatically;
4. Index.

It is interesting to note on this job that the actual cutting time is 93 per cent of the total time required per piece. The index base method of milling cylinder blocks is an innovation introduced by the Hydromatic.

The last illustration, Fig. 10, likewise indicates a step forward in the splitting and straddle-milling of connecting rods. All the operator has to do is to load and unload the pieces. The fixture is automatically indexed, automatically clamped and the table feed and quick-traverse cycles are automatically controlled by dogs. The hydraulic feed makes it possible to start the cut at the normal cutting rate which would be required on any mechanical screw-feed milling machine. When the saw and cutters have entered the work it is possible to speed up the cutting above the normal rate and therefore effect a considerable saving in time. The output is from 140 to 200 connecting rods per hour.

In citing the foregoing examples, illustrations have purposely been taken from internationally known concerns where equipment receives the hardest possible kind of a test and where the management is constantly alert to the most progressive methods. Consequently, it is even more significant when it can be shown that the application of hydraulic feeds to milling machines increases production still further, reduces costs very materially, and increases output.

Helping the Shop Superintendent
Discussion

By John F. Hardecker
Chief Draftsman, Naval Aircraft Factory

THE interesting account on page 27, Vol. 70, of the *American Machinist*, by Frederick Kampmeir concerning scheduled "office hours" has its counterpart in many phases of industry. I have in mind an organization doing a great deal of experimental and development work on large units, which utilizes a system of project engineers to direct this development. Besides their duties in fostering the design in the drafting room, their work calls for maintaining contact between the planning office, shops and purchasing section. Interferences, rejections, substitutions and alteration of design to facilitate production in the shops, all come within their jurisdiction. Hence their duties take them all about the plant, and they are individuals hard to find.

In this case, the project engineers are assigned morning and afternoon "office hours," so that the shop foreman, planner, or draftsmen may have at least two periods in the day when he can be certain of a contact. And, instead of many fruitless searches during the day, he can make one or two positive trips a day to take up all matters at once.

In addition to leaving the project engineers free to attend to their duties about the plant at all times except office hours, the plan saves them time in another way. Without office hours many bridges are crossed before they are reached—the foreman will often try to anticipate contingencies before they happen, so that he will be certain of an answer if he needed it. Now, he is assured of it during office hours.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Al Orders an Emergency Pump

"I HEAR you had a run-in with the treasurer, Al. About that water pump you ordered, wasn't it?"

"Right, Ed, I did. I don't know how news travels so fast, but somebody broadcast the right dope this time."

"Tell me about it, Al."

"Well, you know I've been having trouble with the coolant pump on my big drill. Whoever designed that pump must have been used to sewing machines, for the dinky thing went out of commission almost as soon as we started it up.

"I reported it, and Williams ordered another set of gears for it. They lasted about a week and then quit. Williams was away and we needed that machine mighty bad. So I went to Williams' assistant and induced him to order a separate pump with a motor all its own. We got it in a hurry and mounted it on the base of the drill, and boy, how she does throw soda water! We haven't lost a minute since we got it started up."

"But if the old pump wasn't right, Al, it was the maker's job to fix it. Why should we have to spend good money for a new pump when we paid plenty for one on the machine originally that was supposed to do the work?"

"That's what Brown, the treasurer said, Ed, only more forcibly."

"And what alibi did you have? Seems to me he was right to question such an expense."

"Sure he was, Ed. That's his job. But we told him it wasn't so much a question of who ought to pay for the pump as it was to keep that machine going on the rush job. The machine cost over six thousand dollars, and if you figure up interest and depreciation charges you'll see it doesn't have to stand idle many days to more than pay for the pump. But that isn't all, Ed. With the pump out of commission we couldn't meet our delivery dates on those new machines, and that means more interest charges because we can't get the money for them until they are delivered."

"Was he satisfied?"

"Partly, Ed. But when he talked it over with Williams he got a real jolt. For, if you'll pardon me while I blush a bit, Williams told him he ought to be glad to know we had a foreman with foresight and backbone enough to fight for anything that would save the company money.

"Williams told him to fight it out with the machine builder and get whatever allowance he could. But that even if he couldn't get any, we were ahead of the game."

Did Al display good judgment in insisting on getting the pump? Or should they have waited for Williams to come back? Or gone to the treasurer about it?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Letting Small Savings Offset Larger Wastes

IT'S coming slowly, but modern industry can at least be thankful for even the slow rate of approach of the consciousness that time is the most important element in manufacturing. In this instance, of course, it is not elapsed time, but man-hours and machine-hours. Its not so long ago at that, since we discovered that it was more economical to let a carpenter leave a dropped nail lay than to pick it up.

I have in mind an organization where different departments have different policies as to the supply of lead pencils. In some, an employee may have all he desires, in others he is limited to two a week. The difference in consumption of pencils I am sure might be traced to the ones borrowed or begged from the employees of the liberal department by those of the other departments. Of course, the time lost in these foraging expeditions obviously doesn't enter into the stockroom records, but isn't it important nevertheless?

You can't preach one thing and do another successfully for long. If you are trying to impress the value of time on the men, how can you expect to succeed if you are going to set the example of wasting lots of it, just to keep track of the drills used?

—JOHN W. KANE.

Instructors for Shop Men

HOW long does it take for the new man to become a paying proposition for the company? I would say about three months on the average, and in some cases longer. Many young men fail to realize that it costs a company several months' salary to train them to become a money-making proposition. It takes more than the mere fact of a man having a degree to make him an asset. The sooner the new man is made to realize these facts, the quicker he will adjust himself to the new conditions, and the sooner he will get an increase in salary.

-BENJAMIN C. THOMAS.

Capitalizing Criticism

IF MR. NOBODY cannot be blamed when things go wrong, then the stupidity, inability, or the utter laziness of the night shift is the cause of all trouble; at least the day shift foremen say so. It is much easier to blame someone who is not present, to stand up for himself, than to discover the cause of inefficiency in one's own department.

The attitude of each foreman is to solve the problems of his own department in the easiest way without consideration for others, and to regard co-operation with other departments as outside the fixed routine.

If foremen have the opportunity to criticize one another in the way in which it is done at the Star Company, and it is carried on until both critic and criticized are clear as to what the problem under discussion really is, there is some chance of it being understood as a mutual problem, to be solved by co-operative effort.

—H. JAMES, *England.*

THE·NEXT·TOPIC

Shall Men Clean Their Machines?

ADVANCE QUESTION

Williams finds a shop where the men do not clean the machines they work on, this being done by a "cleaner crew." Ed doesn't like the idea. Al points out some of the advantages. How do you feel about it?

Does Appearance in Tools Count?

I BELIEVE Al is right in saying that tools should receive a finish that will command respect. Especially when such tools or fixtures are designed for permanent use. Also when the fixture is designed for accurate work the workman will be encouraged to use the necessary precautions to obtain accuracy.

There are of course cases where, to get the first machines out, the jigs and fixtures are of a temporary nature. In such cases it is essential to get the tools made accurately and without any frills. It might be left to the tool foreman to designate the finish required on particular fixtures, or the tool designer could make the necessary notes on his drawing. In this way the cost of tools could be kept at a minimum.

—R. N. STRYKER.

I BELIEVE we are beginning to appreciate more and more the effect of appearance in attaining the best results in any undertaking. Tidy shops and well painted machines do not affect production directly, but who will not admit that they do have their effect on the mental attitude of the men, who are influenced to some degree by everything with which they come in contact?

So, when the Evans plant broadcasts the fact that appearance in tools doesn't count, they are flying in the face of the evidence. There is, of course, a practical limit to all this, as for example a machine painted in a single serviceable color accomplishes the same purpose as a striped three color job, and straight lines are just as

pleasing as flourishing curves. Neatness inspires respect, respect inspires careful use, and careful use assures accuracy. —PHILIP H. HOELZLE.

THERE are two kinds of tools; those to be used obviously once, and the other kind to be used either continuously or temporarily, and which must be preserved. The first ones must be accurately made, but do not need to be well finished. Time in making good finish is wasted. The others not only must have a very good appearance but ought to have their name, application, and number engraved on them, and with us we put them in sober wooden boxes and keep them as a part of the equipment of the shop.

Under such conditions the tools are respected by the workmen and the latter never spoil nor lose them, nor are they wasted by ill usage. The time and money spent on appearance is perfectly well justified.

—FAUSTO BECERRIL, *Mexico.*

Getting Ideas from Other Shops

THERE can be no doubt as to the value of visits by foremen and higher executives to other shops, although the treasurer's point of view is not hard to see. The difficulty is, of course, that the treasurer likes to see something concrete for the money he disburses, and the results of visits are often intangible.

In England the great engineering institutions hold annual summer conventions at some well-known engineering center and include visits to important local works as a regular feature of the program. The extent of the visits is sufficient in itself to dispose of any practical questionnaire. The time taken to complete it as being applicable to a different class of shop, would be largely wasted. A few hurried notes about items of practical interest to the particular member would be far more useful. In other words, Al's "Main idea" is all that really matters. —C. NORMAN FLETCHER, *England.*

EVERY workman engaged from another plant, and certainly every foreman, is taken on partly because of his experience. Generally, the more a man has been successful in assimilating details and in understanding processes and methods, the more valuable he is to his new employers.

The right kind of operative will find ideas everywhere. The last man to send out to pick up ideas from another shop is the one who never sizes up the home opportunities. Of two men going down the central bay of the machine shop, one will only notice the time on the shop clock, while the other will have, sensed, in passing, the need for an adaptation to a planer fixture or a simplification to a drilling jig.

—W. R. NEEDHAM, *England.*

Gang Bonus in the Shop

IN ONE plant with which I am familiar, the gang bonus plan has been applied successfully. A group bonus has been applied to a group of workers employed to pick up castings in the foundry, break off the gates and sprues and then deliver the castings to the cleaning room and the sprues to the charging car. The unit of performance is 1,000 lb. of good castings produced, and the standard time is figured in man-hours per unit. If the task is accomplished in the time set, the workers receive a bonus on their hourly wages, as under any bonus system. The bonus is figured on cumulative efficiency during the pay period, and to the base pay of each man is added the percentage of bonus which the group earns. —ARTHUR FRUNCILLO.

Preventing Spoiled Work

A CERTAIN percentage of spoiled work is obviously necessary, but just what the percentage is, is somewhat a matter of viewpoint. The mechanic who will set up each job cautiously, carefully prepare each operation according to the best practice, and check each cut in turn, will probably produce little, if any, spoiled work. But, it will take said watchful mechanic a lot more time on the average than it does the chap who cuts corners, applies little kinks to save time, and occasionally spoils a piece of work thereby.

When however, the spoiled work applies to an entire lot, it becomes carelessness. Someone should be responsible for inspecting the first unit, and if the error is repeated in succeeding units, that particular person has been grossly careless.

—JOHN F. HARDECKER, *Naval Aircraft Factory.*

THERE is no question but that 85 per cent of spoiled work is unnecessary; and that both carelessness and lack of training contribute to the situation. But, I would like to advance the viewpoint that the major cause is not either of the two; but rather a factor that might be classed under the general heading of "supervision," which in this instance covers all that class of information which should come to the mechanic, before or during his actual job, from higher sources.

Under supervision as a contributing cause to spoiled work, I would class errors on drawings, such as incorrect dimensions, unreasonable tolerances and unsuitable material specified. Errors in the delivery of raw material, mistakes in job order instructions from the planning office are also factors. Failure of inspection to find an error early enough in the progress of a job, or only after a considerable quantity of units have been incorrectly machined, is another important cause. For these, and many other factors coming under the broad classification of supervision, the mechanic is often held responsible when their consequences show up in his spoiled work. —JOHN L. STARR.

More Responsibilities for the Foreman

AFTER all, the foreman is placed in his important position, not only as a check upon the work being done, but also as an instructor in the method of accomplishing the job, and it should therefore be part of his duties to make sure that the worker has the right kind of tools for the job and that he knows the best way to make use of them, and understands the instructions given for doing his part of the job.

It is true that many of the workers have not had any real preparation for their particular jobs, and therefore do not understand about the machines they operate and the work they do. It should be within the province of the foreman's job to give these men a better understanding of the machines, of the tools they work with, and of the work, they are doing. —M. BUSWELL.

Building Bus Engines in the *Lancia* Plant

By J. A. Lucas

Methods by which a large crankcase is machined so as to secure accuracy—Special fixtures and tools make duplication possible at low cost

THE crankcase of the Lancia Omicron engine is a large aluminum casting about 43 in. long and weighing over 150 lb. in the rough. The extreme length makes it necessary to consider foundry variations in locating the case for machining.

The mating surfaces are milled in a heavy-duty vertical machine using a large inserted-tooth cutter, leaving about 0.020 in. for finish by grinding. The case then goes to the fixture shown in Figs. 24 and 35 which holds it while the cylinder openings are bored to clear the piston skirt at the lower end of the stroke. Buttons, as at *A*, support the case by its flange, after which it is centered both fore and aft and sideways by special centering plugs. Lengthwise adjustment is determined by the button on the arm *B* that swings on the pivot *C* and is located by a plug that fits into the upper end, at *D*, the button making contact with the web of the crankcase as shown. The locating plug is knurled on the outer end and is shown at *D*, Fig. 24.

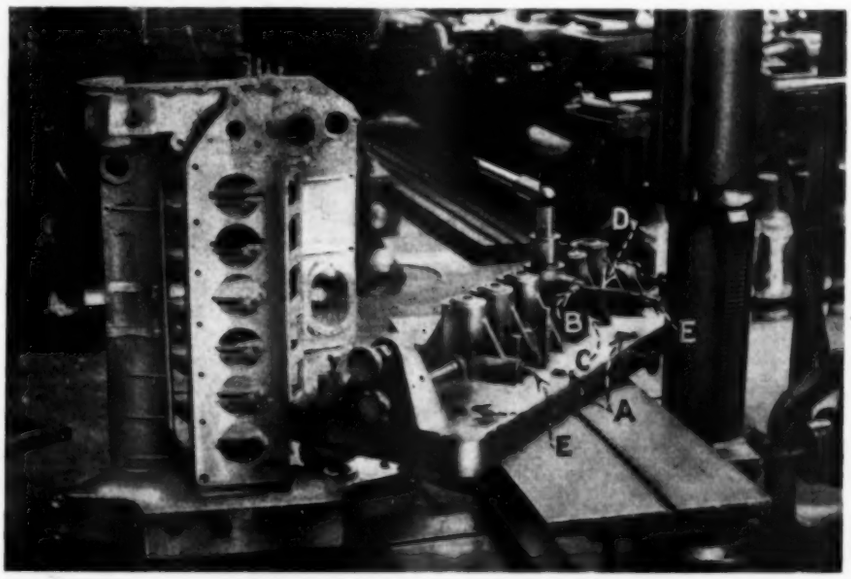


Fig. 24—Boring piston clearance holes in crankcase. The case is centered by points bearing inside of case and located endwise by a stop against the center cross rib

Crosswise location is secured by two pairs of centering plugs as at *E* and *H*. These plugs are operated by cone plugs as at *H*, Fig. 35, controlled by a screw and hand knob. Springs return the plungers as the cone is withdrawn. In this way the case is located centrally in both directions. The loading and unloading time is shortened by the use of hard wheels and wing nuts.

The boring tool is driven through a universal joint and has a pilot that guides it for each piston hole. The views in Fig. 35 show the six guiding bushings in position, and the keyslots in each support by which the bushings can be removed. The holes at each end of the crankcase are used for locating fixtures for future operations and are held to very close limits on this account.

Drilling the stud holes and other similar work is done under a radial drill press as in Fig. 25, using a trunnion jig. The light construction of the jig, with its ribbing, handles and indexing points, is of interest.

More details of this can be seen in Fig. 26. The end holes of the crankcase fit over the posts at *A*, the fit being on ground collars at the base. The posts are also ground at the upper end to fit the collar *B*, in the bushing plate, which is clamped by two T-wrenches as seen in Fig. 28. The drilling time, for the top and two sides, is 15 minutes. Boring the seats for the starting motor and generator is shown in Fig. 27, using a double boring tool with fly-cutters, supported at each end in substantial bearings. The boring bar is keyed to the extension bar at the left. The fixture is located on the crankcase from the two end piston clearance holes, as before. Another boring operation is shown in Fig. 28, where the bearings for the vertical valve gear driving shaft and for the oil pump and filter, are being machined. Here, too, the boring bars are guided by heavy supports. Crankshaft bearing seats are machined as in Fig. 29, the bearing caps having been previously dowelled and bolted into place. Their unusual depth indicates a realization of the need for ample crankshaft support under heavy loads. Two cuts are taken in boring, about 0.020 in. being left for finish reaming. The same setting is used for facing the bearings, by inserting facing cutters, in the slots provided. After boring, and without removing the case from the fixture, the oil pan, which has been machined on the mating surface, is put in position as in Fig. 30 and the end of both parts faced for the flywheel housing and the transmission set, which is supported entirely by the crankcase as is common with unit power plant assemblies. The

The third of a series of articles. The fourth will appear in an early issue.

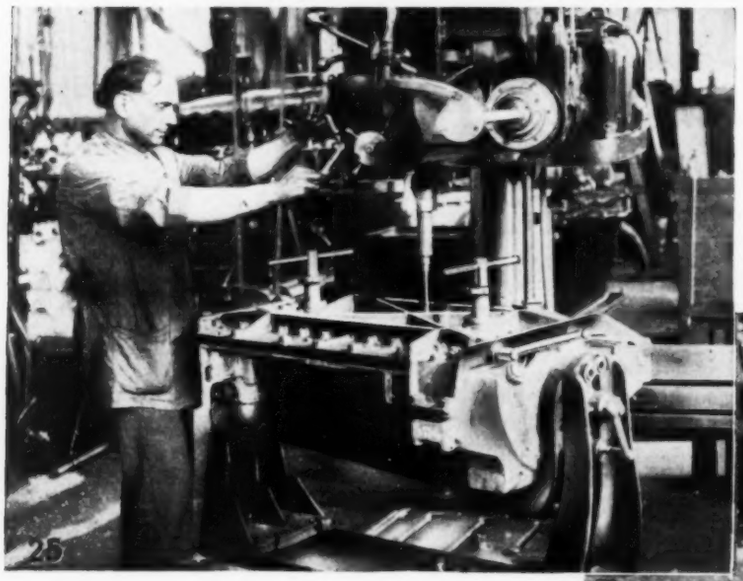


Fig. 25—Trunnion fixture for drilling three sides of the crankcase. The case is located from the two end holes on a collar at the base of each post. The upper plate is locked with T-wrenches

Fig. 26—Drilling fixture with bushing plate removed to show its construction. The trunnion base carries the two large posts that locate both the crankcase and the upper plate

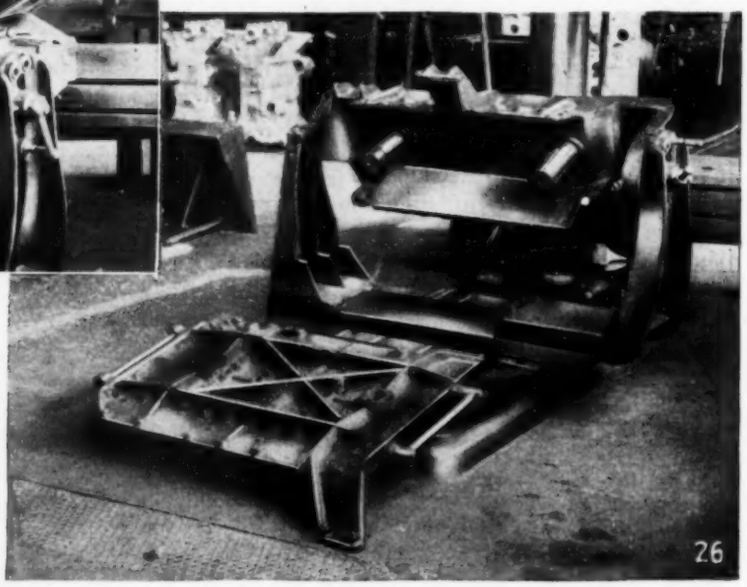
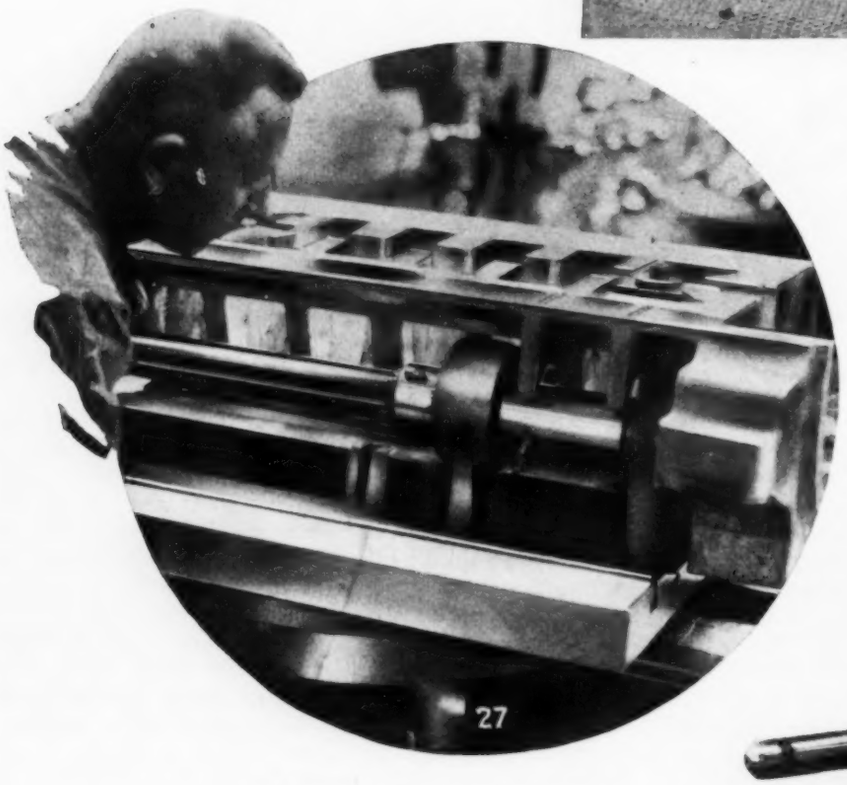


Fig. 27—Boring seats for the electric starter and generator. Heavy supports for the boring bar guide it during the intermittent cuts on the two ribs that locate the starter



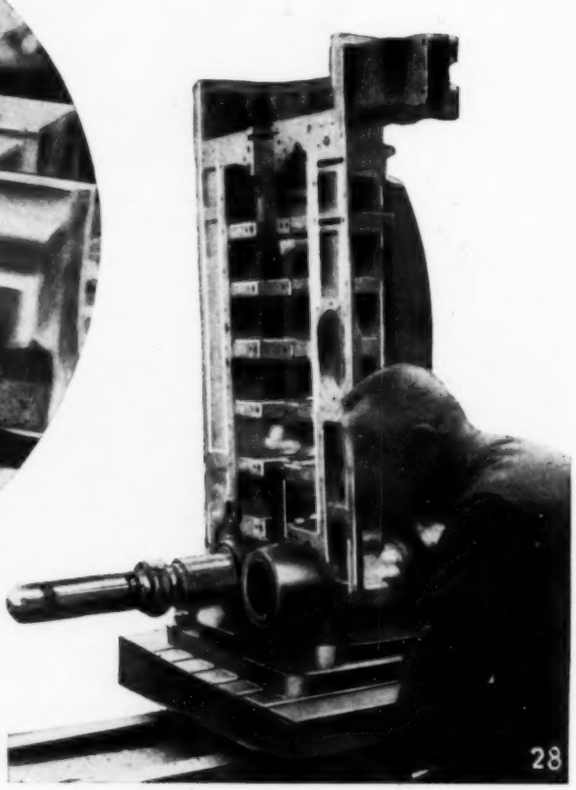


Fig. 28—Finish boring holes for the bearings for the vertical shaft that drives the overhead camshaft. The same fixture also bores another parallel hole

Fig. 29—Main bearing caps in place for boring and facing the seven bearings. Both operations are performed at the same setting, the facing cutters going in the slots shown

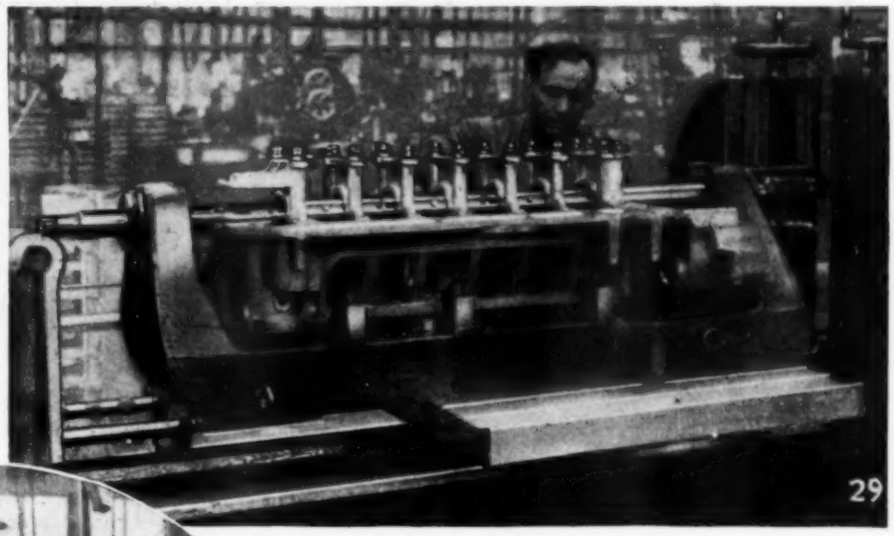


Fig. 30—Facing both crankcase and oil pan. After the crankshaft bearings are bored the oil pan is put in place and both are faced for the transmission case

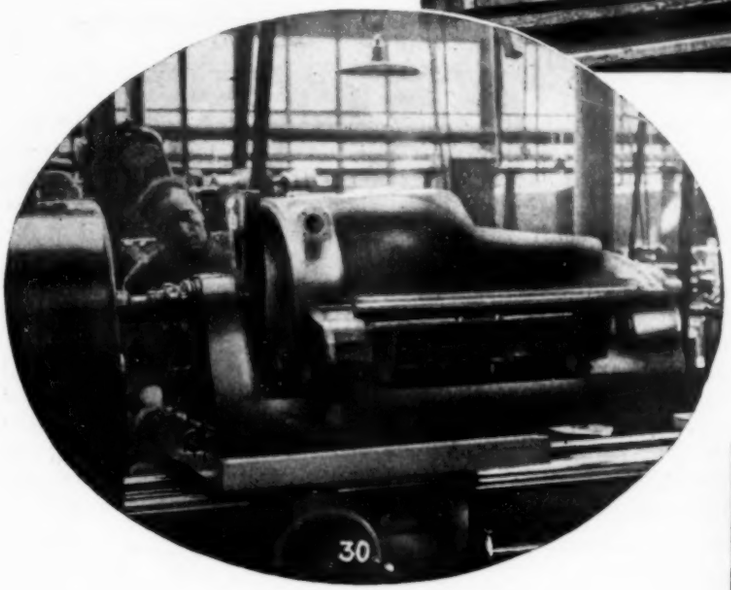


Fig. 32 — Hand reaming the bearing seat for the vertical drive shaft to camshaft. Note how the fixture is located in the bearings and on the end studs

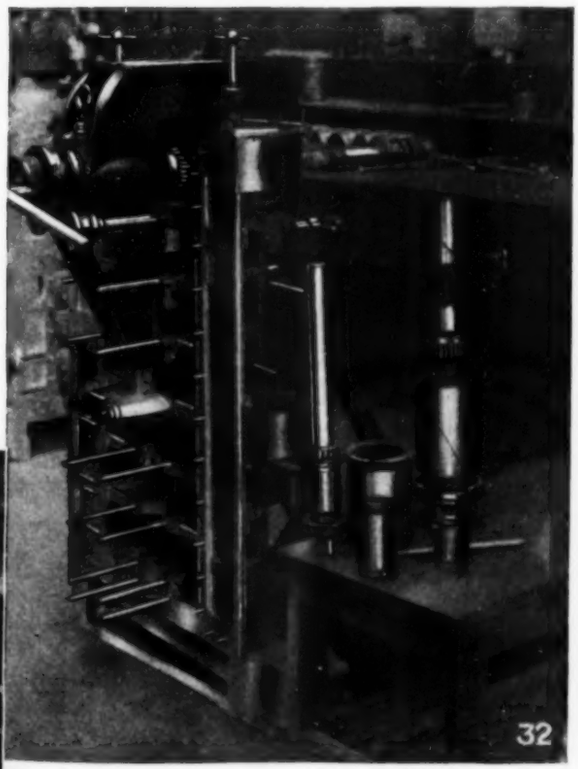
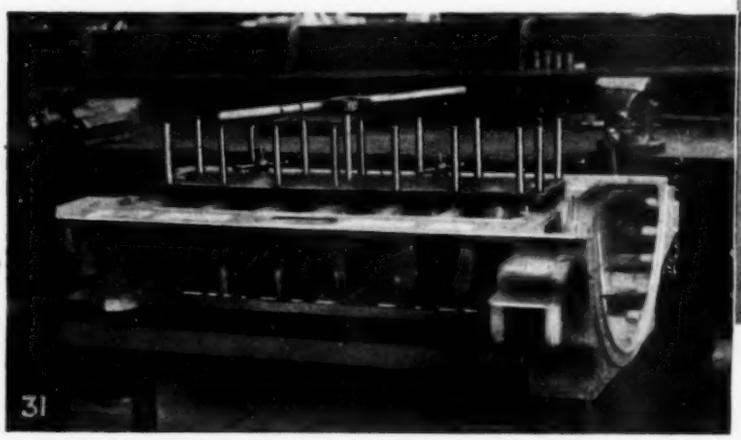


Fig. 31—Fixture for hand reaming the dowel hole for the lower half of each bearing. It registers crosswise from the lower bearing seat, by means of semi-circular blocks, and front and rear from the finished face of the seat



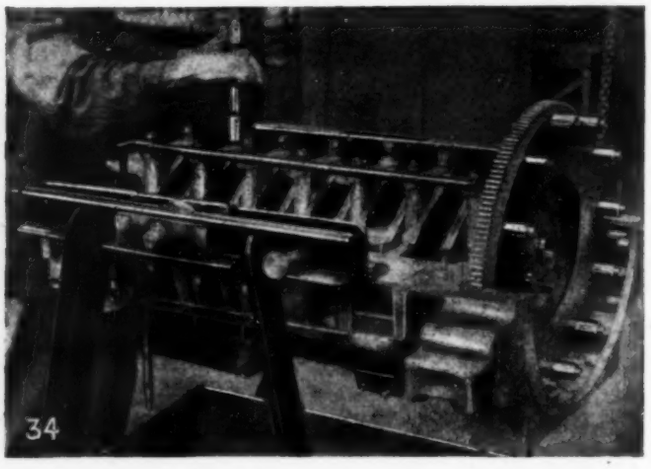


Fig. 33—Guide for hand reaming the bearing for the oil pump drive. The guide is located on the bracket arm on the end bearing cap. Fig. 34—Assembling crankshaft and flywheel in crankcase. Note triangular crank webs and oil line at each bearing cap

operations shown in Figs. 27 to 30 inclusive are all done on a large horizontal milling machine.

After the bearings have been bored and faced, they are hand reamed and then inspected, after which the dowel pin holes for the lower half of the bearing are also hand reamed. The fixture shown at Fig. 3 fits over the bearing cap studs loosely, and is centered by means of semi-circular blocks on arms that extend downward to the seats. These blocks, which exactly fit the finished bearing seat, carry a long bushing for reaming the dowel pin holes. The fore and aft registration is from the finished faces of the seat. The dowelling of the bearing is important, as replacements must fit with little or no adjustment. Before the crankshaft is assembled the bearings are inspected for size and alignment, after which the small studs for the caps are assembled to the crankcase.

The vertical shaft bearings are hand reamed and faced in the fixture shown in Fig. 32. Alignment of the fixture, to insure the bearing seat being at right angles to the shaft, is secured by the bar *A* being clamped in the shaft bearings. The upper end of the fixture is also held by the bearing cap studs at *B*. The facing cutters and their guides, as well as special bushings are shown on the low bench beside the crankcase.

Another hand reaming fixture, for finishing the bushing seat for the oil pump shaft, is shown in Fig. 33. The fixture locates on the extension bracket that carries the pump, and guides the reamers in finishing the bearings at right angles to the crankshaft and in line with the drive shaft from above. Bushings and reamers are seen

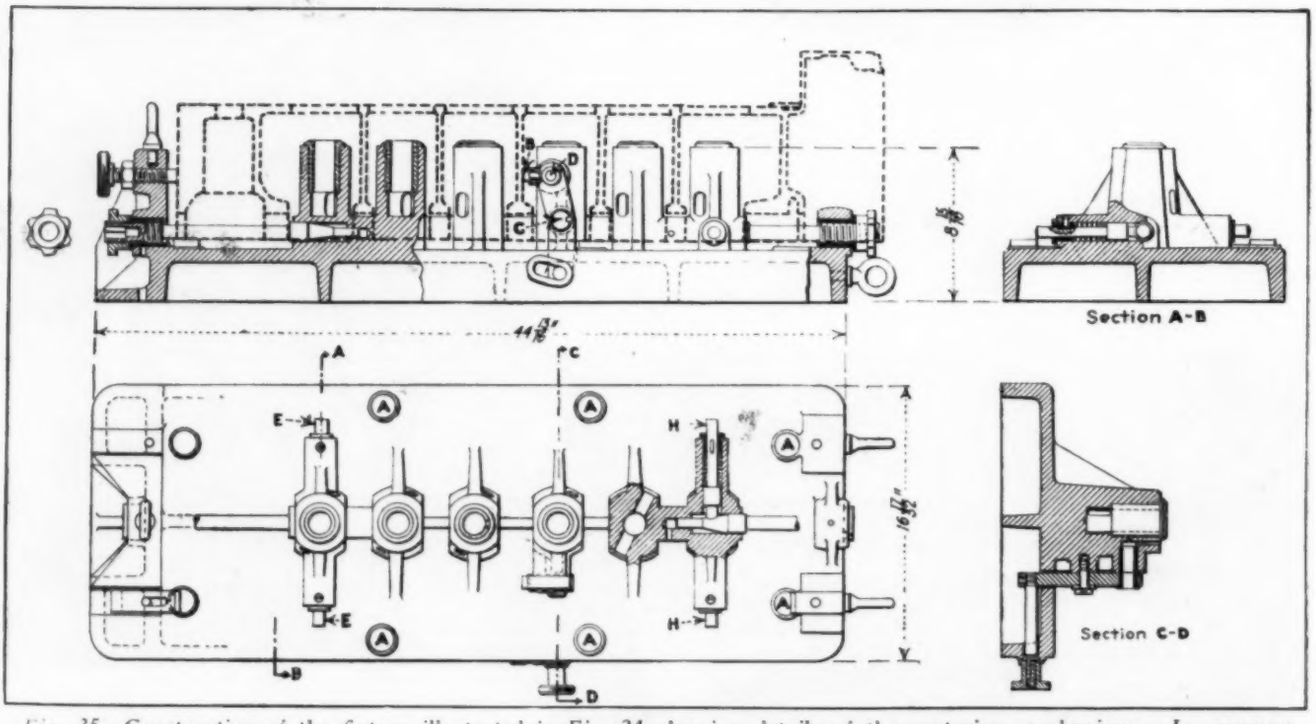


Fig. 35—Construction of the fixture illustrated in Fig. 24 showing details of the centering mechanisms. In common with all Lancia fixtures, handwheels and tail nuts eliminate the necessity for wrenches

on the bench at the right. Their appearance indicates that considerable thought was given to their design.

Assembly of the crankshaft in its bearings is shown in Fig. 34, which also shows the triangular webs on the crankshaft, the studs for mounting the clutch, and the oil pipe line to each bearing cap.

The drafting practice of the Lancia company is superior to our average practice in that it is based upon service to the shop, rather than upon use as engineering records. Their working drawings are not complicated, by a mass of unnecessary figures, and they indicate the degree of finish required.

They are further supplemented by sheets that correspond somewhat to our sequence and operation sheets, but with the advantage of having the minor operations eliminated, and an outline sketch that shows the work to be done, added. The outline sketches shown in Fig. 35 are taken from these sheets. Heavy lines show the operation.

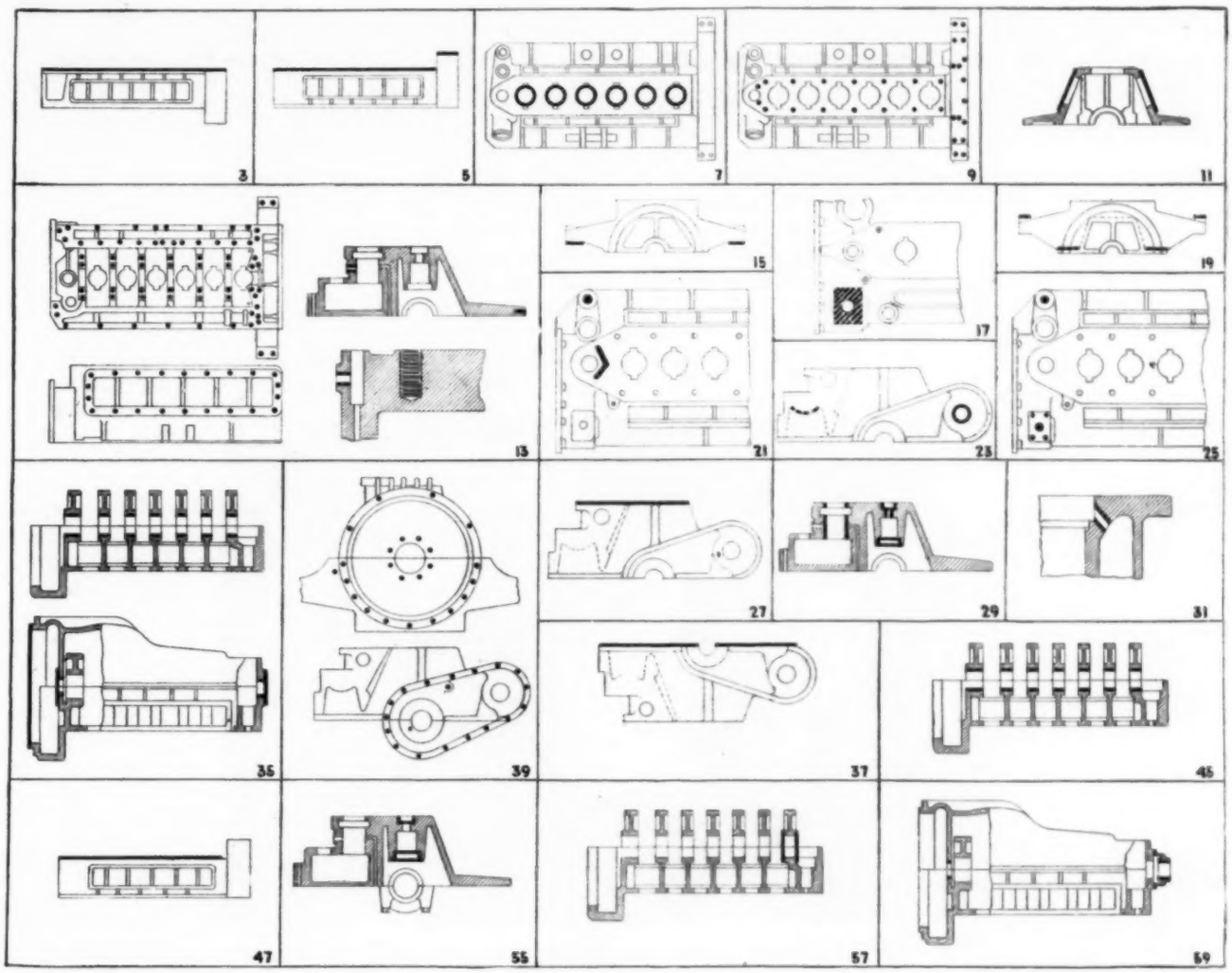


Fig. 36—The diagrams show the principal operations on the crankcase. The sequence of operations is given below

1. Inspection of casting
3. Rough milling face on side of oil case
5. Milling cylinder side face
7. Boring holes for piston's passage
9. Drilling cylinder side face
11. Milling faces for inspection holes
13. All drilling and tapping
15. Milling faces of suspension hubs
17. Milling plane for attaching speed regulator
19. Milling hub faces
21. Milling transverse slot for oil passage
23. Milling seat for generator and starting motor
25. Facing, boring and threading seat for oil pipe
27. Grinding lower side of case
29. Boring seats for vertical shaft and oil filter bearings
31. Drilling hole for oil discharge
32. Drilling hole for fastening vertical shaft
33. Inserting main bearing studs and crankcase studs
35. Boring for main bearing seats—facing bearing supports—application of oil case to crankcase
37. Milling front to receive chain cover
39. Various drilling operations—insertion of studs in rear of motor—fastening starting motor—application of chain cover
41. Dis-assembling and numbering of parts
43. Hand finishing main bearing seats
45. Re-boring front and rear main bearing seats
47. Finish milling upper side of crankcase
49. Various tapping operations
51. Hand scraping upper side of crankcase
53. Insertion of studs to base of cylinder block
55. Hand reaming seat for vertical shaft bearing
57. Hand facing front main bearing
59. Hand reaming bearings for chain driving shaft
61. General inspection.

Surface Hardening *by the* Nitriding Process

By H. W. McQuaid
Metallurgist, The Timken-Detroit Axle Company

Operating practice as worked out by the Timken-Detroit Axle Company has reduced the time of nitriding below that of common practice

FOR many years the casehardening of steel by carburizing and quenching has held its own and no other means has been commercially available to threaten its status in the metallurgical art.

The ease of machining the low-carbon carburizing grades of steel, the ease of cold working, and the low cost, have made the position of carburized articles secure. This was especially true before the days of the high-speed tool steels when the difficulty met in machining the higher carbon steels was a most important factor. The growth of the automobile industry with its demand for greater surface hardness in bearings, gears and pins, has greatly increased the demand for carburized articles, so that carburizing has become a very important factor in the metal-working industry.

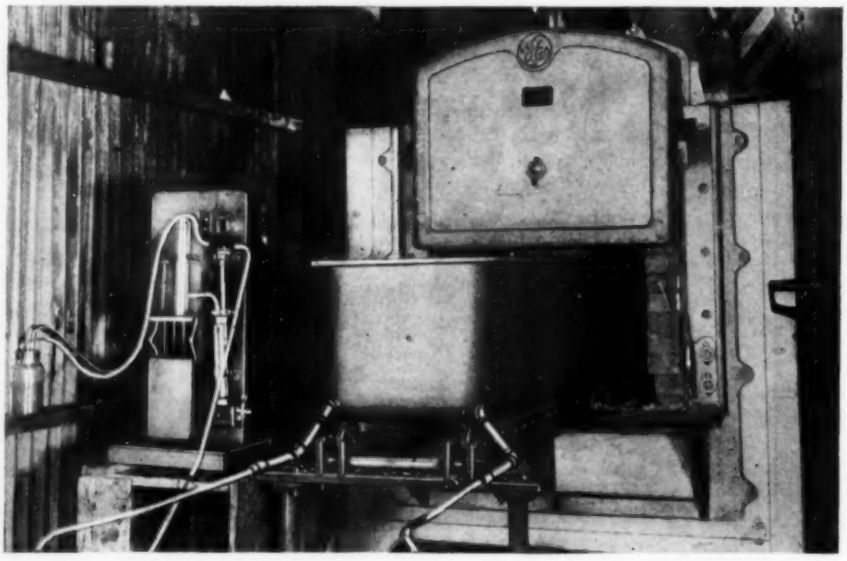


Fig. 1—Nitriding retort, furnace, and equipment for testing the dissociation of the ammonia, as used by the author. The inside dimensions of the retort are 14 x 16 x 48 inches

Casehardening while producing a very hard surface on a relatively soft steel core, is subject to considerable variation, and has several disadvantages. The parts are subject to soft spots which in improperly made steels occur with most discouraging frequency in the ordinary commercial quench. It is necessary, if exact dimensions are required, to grind the finished piece with resultant loss in hardness and considerable expense. The high temperature involved requires heavy fuel input, and the process from a thermal standpoint is very inefficient. It is difficult to control the depth, and variation in furnace temperatures result in great variation in the depth of case obtained so that a large percentage of scrap is at times not unusual. The most important difficulty, however, of the casehardening process is the resultant distortion which occurs after quenching.

Casehardening means the increasing of the carbon content of the outer portion of a low-carbon steel article, so that after quenching from above the critical range, this outer portion will harden under normal conditions in the same manner that tool steel hardens when quenched.

About 1908, Adolph Machlet of the American Gas Furnace Company determined that when iron or steel is heated in an atmosphere of ammonia, above a temperature of 900 deg. F. for a sufficient length of time, the iron or steel would obtain a surface hardness which was hard enough to resist scratching by the file, and was very resistant to corrosion. For this he was granted a patent on June 24, 1913. This process as described by him, when applied to ordinary iron and steel, has only a limited application due to the fact that it is difficult to obtain a sufficient depth of hardness to compete with the ordinary casehardened articles. It is quite useful, however, for some applications where corrosion resistance is important, and where the unit pressures are very light. This process of increasing the surface hardness of steel by the addition of nitrogen to the outside portion has been termed nitriding.

It was not until Adolph Fry, of the Krupp company in Germany, discovered that the process could be greatly improved provided that the steel contained aluminum, chromium, and similar alloying elements that the process aroused any great interest. The addition of aluminum has a very marked effect upon the hardness obtained, and it was found that, with a percentage of aluminum greater than 0.50, and chromium of corresponding amount, an extremely hard surface was obtained which from the standpoint of hardness was even more satis-

factory than the best carburized steel now obtainable.

The new steel had the disadvantage, however, that while the temperature used was not over 1,000 deg. F., it took a long time (approximately 90 hours) to obtain a satisfactory depth, and the resulting nitrogen-hardened piece was very brittle. This brittleness, and the high cost of the alloy, prevented the commercial adoption of the process or the material, except for some very special uses.

It was later discovered that the addition of molybdenum to the nitriding alloy greatly reduced the brittleness of the piece after nitriding, and the molybdenum addition has become an essential part of the nitriding steels which are made at present.

Process Relatively Simple

The process as used today consists in subjecting the finished article to an atmosphere of ammonia at a relatively low temperature, generally below 1,250 deg. F., for a length of time depending upon the use for which the article has been made, and the composition of the nitriding steel which was used in its manufacture.

The Fry patent called for a nitriding temperature of not more than 1,075 deg. F., but it has been found that very satisfactory results, and in fact more satisfactory results, can be obtained at higher temperatures. The articles to be nitrided are placed in a closed retort through which the ammonia is passed at a certain rate, and after a sufficient depth has been obtained, the retort is withdrawn from the furnace and allowed to cool to approximately 250 deg. F., after which it is opened and the articles are ready for use.

An examination of the articles so nitrided will reveal that they have a light gray finish, and are extremely hard when tested with a file. Measurements show that they have distorted not more than a few ten thousandths of an inch, and no subsequent grinding is normally necessary.

If the nitriding steel has been heat-treated before machining, and the process has been properly carried on, it will be found that the finished articles have not only an extremely hard surface, but that they are very tough in comparison with a similar carburized article. If, however, this has not been done, it may be discovered that the case is extremely thin and the pieces quite brittle.

From the above, it can be seen that the nitriding process is a simple one when compared with the carburizing and hardening operations required to obtain a good casehardened steel piece. In setting up a nitriding department, since the temperature required is low, an electric furnace generally operates more satisfactorily than any other type, although a gas-fired furnace can be used without trouble. The furnace should be so designed that the retort can be placed inside of it and ammonia passed through the retort without disturbing the functions of the furnace itself. This can be done easily by having a door which is designed to permit the ammonia pipe to pass under it, and still close the furnace tightly. The retort should preferably be made of an alloy that does not nitride readily, which means one that carries a large percentage of nickel in its composition. The retort should be designed so that ammonia pipe connections can be made to it, and so that the cover can be closed tightly to avoid leakage of ammonia. Ammonia escapes very easily through the slightest opening, and although the pressure is not as a rule more than one or two inches of water in the retort, considerable care should be given to obtain a gas-tight seal. This can be done in many ways using an asbestos gasket or a nickel wire. At The Timken-Detroit Axle Company the seal is made by using a sheet of nickel for a cover, and steel bars bolted down to keep this nickel cover in contact with the machined edges of the retort.

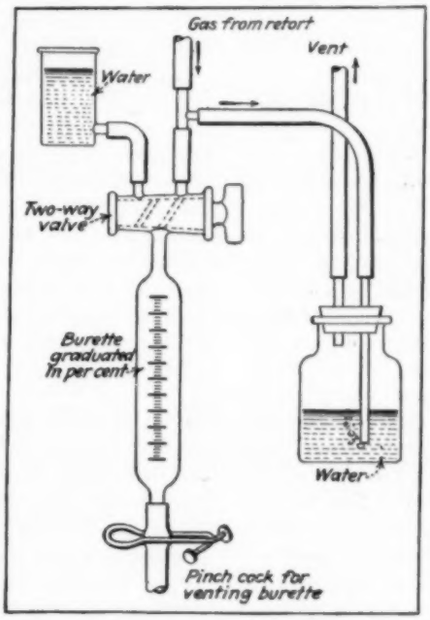


Fig. 2 — Apparatus for checking the dissociation of the gas from the nitriding retort. The burette is filled with gas from the retort, and water is passed into the burette until equilibrium is reached. The height of water indicates the dissociation

It is a great convenience to have the temperature of the furnace automatically controlled so that the temperature variation factor can be eliminated, as the low temperatures are more difficult, than usual in a furnace of this type, to control accurately by hand. Ammonia is obtained in the usual tank, generally of 100 lbs. capacity, and is piped through a pressure reducing valve to the retort and from the retort to a water seal the bubbling of which indicates how much ammonia is passing.

It is very important in this connection that a sufficient amount of ammonia be passed through to insure proper nitriding conditions. It is a well known fact that heated ammonia dissociates into nitrogen and hydrogen, and that the extent of the dissociation is a function of the temperature, the dissociation increasing as the temperature increases, for a given pressure. It is also affected by the presence of iron. It is not definitely known just what part the dissociation plays in nitriding, but it is well known that the ammonia flow should be sufficient to keep the amount of undissociated ammonia in the retort above a minimum figure. At 1,200 deg. F. the percentage of undissociated ammonia should be at least 50, and at 1,000 deg. F. the percentage of undissociated ammonia should be at least 70. The apparatus for checking the dissociation of the ammonia is shown in Fig. 2. The action is based upon the fact that ammonia is extremely soluble in water, while hydrogen and nitrogen are only slightly soluble in water.

Briefly then, to nitride it is only necessary to provide means for holding a retort of the material to be nitrided at a given temperature for a long period of time in an atmosphere of ammonia, and to cool to a temperature of approximately 250 deg. F. in the atmosphere of ammonia.

The circulation of the ammonia in the report is an important factor, and it has been found that agitation or rapid circulation of the ammonia within the retort itself acts to speed up the nitriding operation. The washing of the surface of the work by a stream of ammonia seems to give a more rapid penetration than where the circulation is very slow. Apparently the work tends to surround itself with a passive zone of a high hydrogen concentration which retards greatly the nitriding action. For this reason the use of a positive means of circula-

tion is desirable, but not necessary, and there is no doubt but that special equipment will be marketed to provide circulation within the retort to reduce the time of the nitriding cycle.

Several Types of Nitriding Steels

It is essential that the steel used for nitriding contain a sufficient percentage of aluminum to insure a nitride concentration which will give the hardness desired. This should be approximately 0.50 to 1.00 per cent and the temperature of nitriding must be varied somewhat to suit the percentage of aluminum. The steel also must contain molybdenum in any percentage from 0.15 to 1.00, depending upon the amount of chromium, silicon, manganese, and other hardening elements present. A very satisfactory nitriding steel consists of approximately 0.70 per cent aluminum, and approximately 0.80 per cent molybdenum. If the steel contains a considerable percentage of chromium, say 1.00 per cent or over, the molybdenum need not be more than 0.25 per cent. In this case, the molybdenum is added to reduce the brittleness of the finished nitrided piece.

The carbon content for general purposes should be from 0.30 to 0.50 per cent. The higher carbon steels tend to nitride easier, but are quite difficult to machine, especially when the chromium is high. On the other hand, the core strength of the nitrided piece depends to a large degree upon the carbon content and if a very high core strength is desired the carbon should be kept on the high side. It has been found that decarburization has a very adverse affect on the nitriding results, and it is very important that none of the surfaces which are to be hardened be decarburized, which means that in machining all of the oxidized surfaces should be removed. In nitriding, the hydrogen in the retort must be kept below a point at which it will remove carbon from the steel and prevent the nitride from forming, which means as stated above, that the undissociated ammonia should be not less than approximately 70 per cent of the volume in the retort.

At the present time, the price of the nitriding steel is sufficiently high to prevent its serious competition with the carburizing grades, but it is evident that as soon as the price can be reduced, the superiority of the nitrided piece and process will insure its wide use, with consequence cheapening of the price. The patent situation is quite involved, and it is possible at the present time to obtain two different kinds of nitriding steels, neither of which is much superior to the other, but which vary considerably in price.

The condition of the surface to be nitrided seems to have a very important bearing upon the results, and some otherwise baffling results can be attributed to some condition of the surface. It has been found at The Timken-Detroit Axle Company that pieces to be nitrided should be carefully washed and dried and handled as little as possible to avoid a soft surface after nitriding. Just what conditions are detrimental to the nitriding are not known as pieces have been satisfactorily nitrided which were somewhat oily, and other pieces were very satisfactorily hard everywhere except where handled in loading the retort. At the same time pieces have been found which would not nitride satisfactorily after machining and it is thought, but has not been proved, that sulphurated oils or perhaps lard-base cutting oils when improperly washed off have a detrimental effect. This particular phase is being carefully studied, and without a doubt the conditions which produce the best results will be fully determined. It is the best practice, therefore, to be sure that the material itself is well cleaned and dry before nitriding.

The temperature of nitriding has an important bearing on the character of the case obtained, and upon the time required to obtain a satisfactory hard surface. Machlet, in his original patent, specified any temperature above 950 deg. F. Fry, in his patent, specified a temperature not over 1,075 deg. F. At the present time most of the nitriding steels are being nitrided at a temperature of approximately 1,000 deg. F. This has the advantage that the core strength will be greater than if the nitriding temperature is higher. At the same time, at this temperature the time required to obtain a very hard surface of sufficient depth amounts to many hours.

At The Timken-Detroit Axle Company it has been found that the most satisfactory results were obtained by nitriding on a cycle of 1,200 deg. F. for 10 hours, and then dropping to 975 deg. F. for 15 hours, the complete cycle including the cooling periods being not over 30 hours as compared with 90 hours for the lower temperature case. The improved results can be explained by the fact that at 1,200 deg. F. the ammonia penetrates much more rapidly than at the lower temperature, but does not build up a sufficiently hard case for most purposes, while the final period of 975 deg. F. builds up an extremely hard surface which has been found to be equal to the case obtained at the longer runs at the lower temperatures. It is very important that the concentration of ammonia be maintained at the high temperature, since at 1,200 deg. the dissociation of ammonia is more rapid than at the lower temperature, and the decarburizing action of the hydrogen much more pronounced. For this reason considerably more ammonia must pass through the retort at 1,200 deg. than at the lower temperature.

If this procedure is followed, it is possible to construct a two-chamber furnace in which the retort could be held for 15 hours in one chamber at 1,200 deg., and then moved to the second chamber where it could be held at 975 deg. for 15 hours. Thus we could obtain a retort full of work every 15 hours, with a total cycle in the furnace of 30 hours.

Sheet-Metal Products, Their Design, Use and Construction

In the modern competition of product with product the sheet metal industry is making things warm for some of its competitors. Many machine parts and other articles that were formerly made from castings or forgings are now pressed or stamped at less cost. Next week the first of two articles under the title given above will be published. The principles involved are illustrated by practical examples and designs.

Legal Protection of Conditional Sales Abroad

By V. E. Greaves
Marvin and Bergh, International Attorneys

Sales of costly machinery abroad often means extending credits which cannot be covered by our familiar conditional sales contracts

SAFE credit policy together with aggressive merchandising is the fundamental problem of foreign trade that is ever present in the mind of the exporter, no matter whether he wishes to penetrate into a new market or retain the old ones for his product. Selling for cash or an extreme conservatism in opening credits is safe, but under the present condition of world competition, will make merchandising on a large scale next to impossible. On the other hand, a too liberal credit policy may facilitate sales, but will inevitably increase the ratio of commercial losses to such an extent as to drive the exporter from the foreign market as surely and promptly as an over timid credit policy would do. The credit problem becomes especially acute when the exporter does not deal in commodities, but in large engines, machinery, trucks, motor cars and other heavy and high-priced articles that run into large sums of money.

Increasing interest of American manufacturers in foreign trade, resulting in larger machinery sales than ever before, makes it necessary for the manufacturer to note how he can protect himself legally in extending credit where the foreign buyer cannot pay cash on delivery

An exporter of miscellaneous commodities can easily adapt the size of his credit sales to the actual credit standing of each individual consignee, limiting the credit shipments, if need be, even to a few hundred dollars.

This cannot be done if the exported goods consist of machines costing many thousands of dollars. If the buyer cannot pay cash, either a large credit must be opened on each single deal, or the sale will not be consummated. Many good foreign customers will not qualify as potential buyers only because of their restricted credit rating, and so the market is necessarily narrowed, to the direct detriment of the exporter.

This obstacle, however, is not unsurmountable. Excellent markets may be materially widened for safe credit exporting if, instead of shipping on clear credit terms, it can be arranged to sell goods to the foreign customers conditionally with the retention by the exporter of the title to the merchandise until the full price is paid.

The immediate legal effect of such sales terms will be the complete protection of the seller against the creditors of the buyer in case of the latter's bankruptcy, and this alone will permit the shipping of goods on credit to buyers with small credit rating but good moral reputation, where the exporter may be afraid only of the buyer's failure, but not of the conversion by him of the machinery not yet paid for.

If in addition to this, legal means can be found to make the retention of title valid as against third parties, including purchasers in good faith from the conditional buyer for consideration, then the credit problem will present no difficulties whatever, as the whole question will be reduced to the salvage value of goods conditionally sold, whether or not, in case of the buyer's refault, these goods could be resold without substantial loss to the exporter. As usually, the buyer will pay freight, duty and other landing charges, and probably also a substantial installment on account, it is safe to assume that in the great majority of cases, the losses on resales may be kept well within the limits of the usual average losses in a given line of trade for the respective country.

In the United States this problem has been fully solved in most states by passing special "Conditional Sales Acts" under which conditional sales may be recorded and thus become effective not only between the parties to the contract, but also against all third parties, including innocent purchasers. Conditional sales are also acknowledged and regulated by law in Porto Rico and upheld by courts in Hawaii and the Philippine Islands.

Similar statutes have been enacted in the Canadian provinces of Alberta, British Columbia, New Brunswick, Nova Scotia, North West Territory, Ontario, Yukon and Prince Edward Island. In the province of Manitoba conditional sales contracts cannot be recorded, but in accordance with the Lien Notes Act the same legal effect can be obtained by attaching conspicuous labels to the merchandise sold if it consist of *manufactured* goods, bearing the name and address of the vendor. The Quebec civil code considers conditional sales contracts as obligations under a suspensive condition, valid as between the parties to the contract and also against the creditors of the vendee in the case of his bankruptcy. Thus, in regard to our largest and best foreign customer, Canada, selling on credit can be easily arranged on as

safe a basis as is ordinarily found in the United States.

As to England herself, and other English dominions and colonies, the legal protection of conditional sales is considerably less effective. Although conditional sales are recognized by law, still in view of certain peculiar rules of bankruptcy laws, factors acts and bills of sale acts, a rather limited relief can be had against the creditors of the vendee, and as to third innocent purchasers from the latter, the protection is even less effective, consisting only of recorded bills of sale,—an antiquated remedy that is seldom, if ever, used.

Among the continental European countries, only Switzerland has a law similar to our conditional sales act providing for the recording of sales contracts with deferred surrender of title. These contracts if properly recorded have full legal effect against all third parties without restriction.

Another European country where full protection can be had on conditional sales contracts is Spain. The statute there is silent on this matter, but the supreme court in a recent decision recognized the retention of title under conditional sales contract as lawful and valid, not only against creditors, but also against all third parties, including innocent purchasers.

In all other European countries, contracts of different types can be made with the vendees retaining title to the goods sold until the full payment of the price—hire-purchase agreements, deposit with option to buy, special forms of consignment, conditional sales contracts, etc. All of these contracts will be good between the parties, and in case of the vendees' bankruptcy, will give the vendor the right to re-possess the goods from the bankrupt's estate. As to third innocent parties, these contracts will not be effective, and if the vendee sells the goods to a purchaser for consideration, they cannot be revindicated by the vendor unless the purchaser knew, or should have known of the retention of title.

Credit in the Form of a Privilege

In France and Belgium the civil codes give special protection to the seller on credit in the form of the so-called "privilege" (lien) for the total balance of the unpaid price. However, this lien is good only (a) if the property remains in the hands of the original buyer, and (b) if the buyer is not a merchant. In case of a merchant's bankruptcy, it will not operate against other creditors. Still, in Belgium, sales on credit of machinery and equipment used in industrial establishments may be recorded with the commercial court and then become valid in case of the buyer's bankruptcy, within two years from the date of delivery.

In Denmark, Norway and Finland laws have been passed permitting the recording of chattel mortgages. However, these laws are rather restricted in their scope, referring exclusively to mining and industrial property.

It may be mentioned that if the goods conditionally sold consist of heavy machinery which it is customary to inspect before purchasing, especially second-hand machines, the affixing to them of large indestructible labels announcing the retention of the title possibly might be considered by the courts as a sufficient notice to purchasers, which would eliminate the defense of good faith from those who failed to inspect the property, or, having inspected it, failed to observe the label. However, only Czechoslovakian courts have adjudicated definitely that such labels are a valid notice as against third parties. In other countries, the question of the validity of such labels remains exclusively in the domain of theoretical consideration, and no lawyer will vouch to his clients that the courts of any given European country will uphold this method of notifying third parties of the retained title.

In Central and South America, the laws of retention of title greatly vary from country to country. However, the general trend of recent legislation and adjudication by courts is to uphold the validity of these contracts against all third parties, although in the majority of these countries full protection cannot be had against innocent purchasers for consideration from the conditional vendees.

Peru has recently enacted a special law, similar in substance to our statutes, which permits the recording of conditional sales, effective against third parties. The new civil code of Mexico contains also detailed rules concerning conditional sales and retention of title. This code will go into effect in the near future.

Cuban Court Decisions

In Cuba, although there is no registration of conditional sales contracts, the same legal effect has been attained by the interpretation given by the local courts to the provisions of the Cuban civil code covering contracts under suspensive conditions. The Supreme Court of Cuba, following the example of the Spanish courts, in a recent decision held that sales with retention of title until the full payment of the price are legal and, therefore, the legal effects of such sales must be valid as against all third parties. Consequently, the goods so sold may be revindicated by the owner even from third innocent purchasers. This decision may stand in some contradiction to other provisions of Cuban law, but it is now the law of Cuba, and as such gives full protection to conditional sales.

In Argentina and Costa Rica, instead of retention of title, the exporter may have practically the same remedy in the form of the so-called "prenda agraria" (agrarian pledge) which is a peculiar kind of chattel mortgage that, notwithstanding its restrictive name, may be executed on any property, even though not related to agriculture. Agrarian pledges are also recognized by Chilean law, but they are limited there only to property that is to be used in connection with agriculture.

An irregular form of chattel mortgage is known in the Dominican Republic under the name of "loans with guaranty by personal property" (prestamo con garantia mobiliaria). This peculiar cross-breed between conditional sales and secured debts is not regulated by statute, but constantly used in daily practice. Local lawyers are of the opinion that these loans may be valid against third parties.

In other Latin-American countries, various forms of contracts are widely used in the case of conditional sales, such as hire-purchase contracts (arrendamiento con promesa de venta) in Honduras, Colombia, Chile and the Dominican Republic; deposit with option to buy (deposito con opcion de venta) in Nicaragua, Guatemala, El Salvador, Venezuela and Uruguay; and even conditional sales contracts pure and simple, in Brazil, as an alternative to hire-purchase contracts and consignment contracts in case of large shipments to dealers. However, as in Europe, all of these forms of contracts, fully protecting the seller against the buyer's creditors, are not operative against third innocent purchasers for consideration.

To sum up this short review of foreign laws and practices in regard to conditional sales, it may be said

that gradually the American principle of conditional sales with retention of title is penetrating into the domain of civil law, and where the corresponding statutes have been enacted, as in Switzerland, Peru, Mexico, Argentine, Costa Rica, and partly in Chile, Italy and Venezuela (in the two latter countries in regard to motor cars), or where courts have upheld the validity of conditional sales against third parties, as in Spain and Cuba, the exporter is protected not only against the bankruptcy of the buyer, but even against his dishonesty.

In other countries, the exporter is fully protected against the creditors in the case of his buyer's insolvency, but has no defense against innocent purchasers from the conditional buyer, and, therefore, in case of his dishonesty will have no remedy except his civil and criminal liability. In other words, even in those countries it may be safe to ship on credit terms to a consignee who has only a very moderate credit rating, provided he is considered as a good moral risk.

Of course, conditional sales contracts must be drawn in strict accordance with the laws and practices of each individual country where the goods are shipped. A slight inexactitude in the structure or terminology of the contract may sometimes defeat its purpose as an instrument retaining title with the seller and give the buyer the absolute ownership of the goods sold.

Johnson Chucks the Time Clock

Discussion

By F. W. Oliver White
Derbyshire, England

REFERRING to Mr. Godfrey's article on time clocks, on page 885, Vol. 69, of the *American Machinist*, I believe the question of "clocking-in" on the minute is one of discipline more than anything else. In few cases can it make much difference to production if a man is five minutes late. The trouble occurs when the percentage of the late ones increases and the same people are late frequently. In any case, very few workers will start work at exactly the same moment, and oftentimes those who hang about the machine for a few moments will be those who will plug away hardest, and, taking an interest in their work, get out more of it, and maybe work on a few minutes after the quitting whistle has blown.

We sometimes forget that men are not machines that can be started and stopped by turning a handle. The use of time recorders is well established all over the world, and it is difficult to see just how any other system can take its place effectively. To do without it in the small shop is not difficult, but to abolish it in the big works would be almost impossible. Not only does it give a check on those who are late, but it enables the office to know how many absentees there are, and their names. It is a vast improvement on the older systems, such as brass checks.

Punctuality and such like excellent habits do not always go hand in hand with brains. A discussion on which is the most needed in modern industry would be interesting. The clever designer who spends most of his time dreaming, will often hit upon an idea that is worth far more to his employer than the entire year's wages of all his hard-working fellow draftsmen put together, the fact that he is often late, and that his colleagues punch the clock on time every morning, notwithstanding.

SEEN · AND · HEARD

By John R. Godfrey

Close tolerances—Multi-motor not new—Riveting with explosives

CLOSE tolerances do not always tell the full story of the accuracy of a product. Piston pins, for example, are made with varying tolerances, according to the cars for which they are intended. Just at present a tolerance of "two-tenths" is fairly common for good pins. But as a rule, these are the tolerances demanded for engines that go into cars in the lower price ranges.

Piston pins made for cars in the higher price class frequently permit a tolerance of a "half-thousandth." This does not mean that the engine of the higher price car is not fitted as accurately as the cheaper car with the closer tolerance. The contrary may be true. The higher price engine is assembled with greater care and the parts are so carefully selected that the fits are just right, as we know fits at present. The low cost engine must have parts that fit satisfactorily with little or no selection. Hence the demand for closer tolerances. Things are not always what they seem.

* * * *

In spite of all the improvements that have been made in machine design and construction, it is a bit surprising at times that some of these changes have come so slowly. An example, recently brought to my attention, was the use of multiple motors on machine tools instead of taking off power by gears, shafts, or chains from a central source, as formerly.

Traveling cranes, if I am correctly informed, began using unit motors for each movement as long ago as 1893, with one motor for travel, another for the traverse movement of the hoisting carriage, and a third for the hoist itself. The design, however, was not due to the crane builders, but to a customer who insisted on having the crane built that way. And only a lack of orders and a threat to take the business elsewhere made the builder consent to undertake such a monstrosity.

With this obvious example before us, it seems strange that the use of separate motors for operating different functions should have been so long in making its appearance in machine tools and other types of machinery. Mental inertia, the tendency to stick to things as they are, is still a great hindering force to be reckoned with.

* * * *

There's a new shop development of an entirely different kind—the use of a small charge of explosive in a suitable gun to shoot steel pins or hollow pipes through several thicknesses of steel plate, totaling two to three inches. The size or shape of the pin doesn't seem to matter, as in one case the gun drove a four-fluted tool through a half-inch piece of steel, leaving a nice hole with internal splines. One use at present is to pin structural plates together before welding and it is probable that many other uses will develop. It cuts a clean hole, hardens the metal surrounding it because of the greatly increased density, and is altogether well worth looking into.

IDEAS · FROM · PRACTICAL · MEN

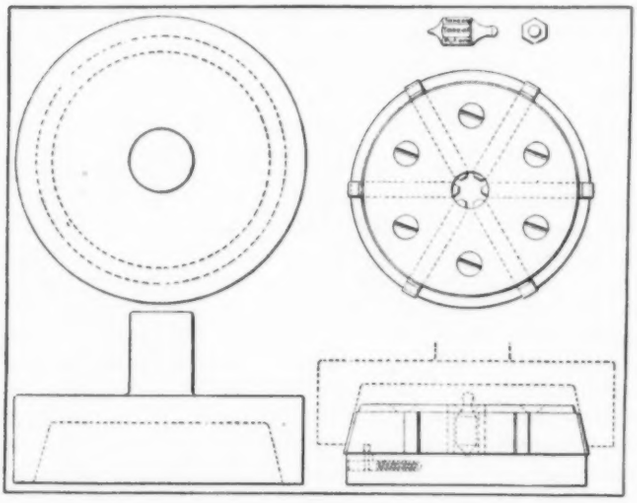
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Press Tools for Stamping "Toddle Tops"

By Harry S. Taylor

About a year or two after the World War, everyone seemed to have the craze to spin "Put and Take Tops," or as some called them, "Toddle Tops." Being in the jobbing business, we received an order for 50,000 of these tops to be made and lettered as shown in the accompanying illustration.

We machined the tops from hexagon rods in our small Acme automatics and then stamped them in the press



Press tools for stamping letters on all sides of a hexagon

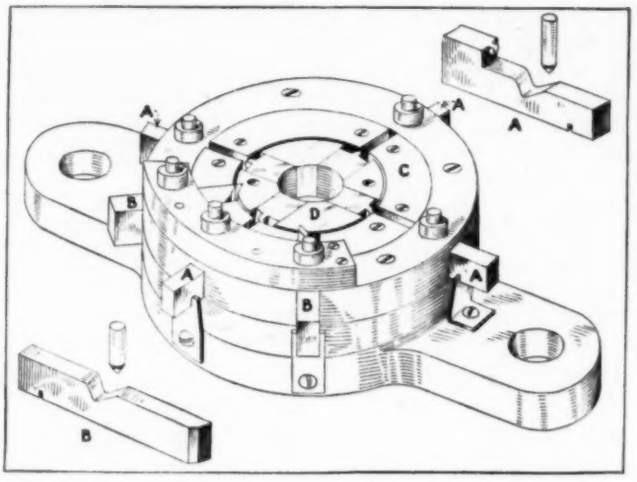
tools shown in the drawing. As will be seen, the six punches slide in channels in the die-block, and are driven inwardly by an internally-tapered piece held in the press ram. As the ram descends, all six of the punches are moved simultaneously, stamping the lettering on all sides of the top at one stroke of the press. The stamping was done at the rate of about 800 per hour. The tools worked very successfully in a small press and enabled us to complete the order in record time.

Press Tools for an Operation on Ammeter Cases

By Charles H. Willey

In the manufacture of ammeters for a certain make of automobile, it is necessary to have four protruding points on the outsides of the cases to make the tops fit nicely, and two intruding points on the insides to locate the magnets.

Desiring to do all the work in one operation, we de-



Tools for making protruding and intruding points on ammeter cases

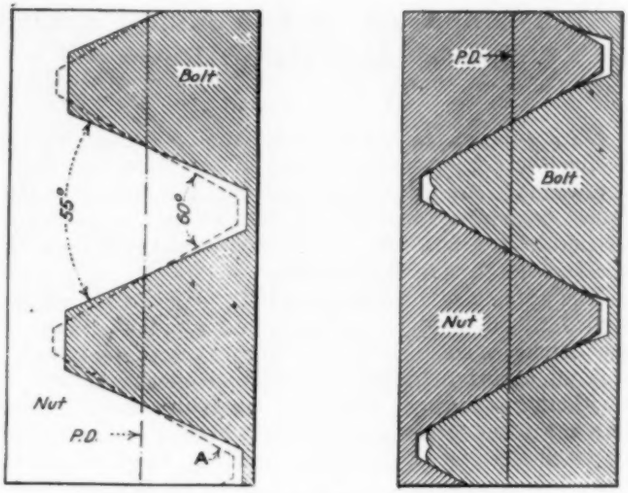
signed the press tools shown in the illustration. The four slides *A* carry the punches for making the protruding points, the two slides *B* carry the punches for making the intruding points. All the slides are operated simultaneously by conical-ended pins driven downward by the ram of the press, the points of the pins engaging beveled slots in the slides. The pins and the beveled slots in the slides are so located in relation to one another that four of the slides are moved outward and two inward as the press ram descends.

The slides are returned to their normal positions by stiff flat springs. The ring *C* forms the dies for the four punches for making the protruding points, while the part *D* forms a part of the guides for the slides and the stripper, and also forms the dies for the two punches for making the intruding points.

Expansible Threads—*Discussion*

By Homer Marion

It seems to an onlooker that Henry Simon in his original article on page 1016, Vol. 68, of the *American Machinist*, and R. G. Hewitt in his answer on page 549, Vol. 69, are both somewhat mistaken. Mr. Simon shows no way of releasing the expansion on his *A* and *B* designs, and no method of expanding his *C* bolt other than Mr. Hewitt shows in his design. In making this statement I am assuming that the tapped holes are blind in each case. The only way that the expansion can be relieved at will is to use a taper pin with a threaded straight part, and after the bolt is screwed home to draw up on the taper pin until the bolt is tight or the small thread breaks. When it is desired to remove the bolt a drift



Tight fitting nut and bolt secured through different angle threads

will back the taper pin out far enough to relieve the strain.

I think that Mr. Simon is mistaken when he says that drilling the solid part of a bolt will make it stronger. I will agree that for all practical purposes it is not made weaker, because the threaded diameter is already the weakest. What Mr. Simon has in mind I think, is that a tube is stronger than a solid bar containing the same amount of metal, but not stronger than a bar of equal diameter.

But, why go to so much trouble to secure tightness when it is easier and cheaper to make a thread that will fit tight without any external means. In the Transactions of the A.S.M.E. for 1920 there is described a method of securing tight fitting nuts and bolts, by a simple logical method.

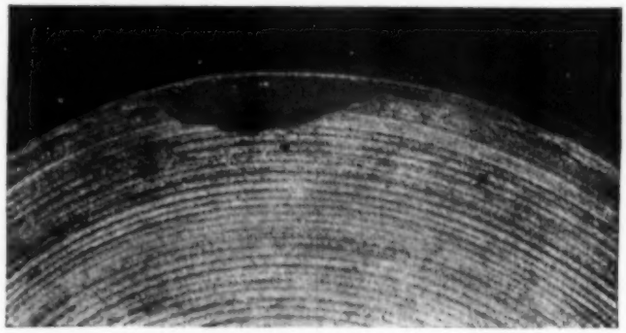
Briefly it consists of screwing a Whitworth bolt into a United States Standard nut, or tapped hole. The nut having an included angle of 60 deg. between the flanks of the teeth, and the bolt having 55 deg. the lesser is made to contain the greater, angularly speaking. The result is that the nut acts as a finishing die, and the bolt fills it out as shown in the illustration. The angles cross at the pitch line and the clearance at *A* is less than the tolerance allowed between the bolt and nut on class 4 Standard bolt fits. The thread differs from the Whitworth slightly in having a square top and a slightly shorter tooth, but when cut by a die, it is practically the same. No distortion or enlarging of the nut can be detected, and the bolt can be screwed in and out many times without becoming loose.

Repairing a Grindstone

By Matthew Harris

In backing to make a turn on a wharf, one of our trucks ran into an unmounted grindstone and knocked a small chunk out of the face. We had to pay for the stone, so we brought it to our warehouse. As I had a shop at home and needed a grindstone, I bought the damaged one from the firm for a nominal price and had it sent to my house. My intention was to make a mount for it and turn it down below the damaged spot. I made the mount and mounted the grindstone, but never got around to the turning-down process.

One day I was doing a little concrete work around the place, and it occured to me that a mixture of cement and sharp sand might be used to fill in the broken face of the grindstone. So I sawed a couple of short boards to the radius of the stone and clamped one of them on each side of it. Then I filled the broken spot with a mixture of cement and sand, and struck it off with a



Broken grindstone patched with cement and sand

board that spanned the boards on the sides of the stone. The illustration shows the completed patch.

The stone has been in use for several years and apparently is as good as a new stone, the patch appearing to be of about the same hardness, grit and grain as the stone itself. Of course, if the stone were used continuously, it might wear away at a different rate than the patch, necessitating frequent dressing.

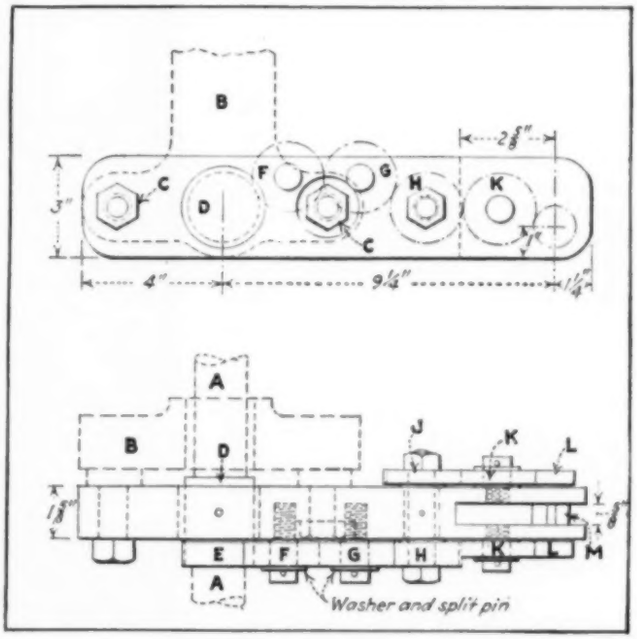
A Milling Attachment for Cutting Internal Gears

By Horace James

Birmingham, England

The illustration shows in detail a milling machine attachment originally designed for the purpose of cutting slots 0.050 in. wide x 0.195 in. deep, on the inside wall of a ring 18 in. dia. x 4 in. wide.

Its possible future usefulness in cutting internal gears



A gear train and cutter for cutting internal gears

was kept in mind during its design, and it will cut internal gears of $4\frac{1}{2}$ in. and over. With a hollow quill and the proper end mills it will cut internal cams and spirals. We have no rack-cutting attachment, and this fixture has also solved that problem.

The attachment was used on a No. 2B Milwaukee miller, but is adaptable to any similar machine. The body is made from a mild steel bar, 3 x $1\frac{5}{8}$ in. cross section, and bolts to the arbor support *B* of the milling machine. The spindle *A* carries a 2-in. steel bushing *D* and a spur-gear *E*. The motion of the spindle is transmitted through the gears *F*, *G*, *H*, *I* and *K* to the cutter arbor *M*. The gears *E*, *F*, *G* and *H* are 24T, 12 d.p. x $\frac{3}{4}$ in. face, while *I* and *K* are 14T, 12 d.p. x $\frac{7}{16}$ in. face. One of the gears *L* is integral with the cutter arbor *M*, the other one being keyed to it. Both *L* and *M* are of nickel steel.

The spur-gear *L* was reduced to the smallest possible diameter to allow of small internal gears being cut; this is also the reason why the drive is double. While the fixture is not sufficiently rigid to meet the demands of mass production, it will enable the small shop to do some of the jobs they have been obliged to turn down heretofore.

It will be noticed that considerable accuracy is necessary in order to preserve the proper pitch circles on both sides of the body, and that means must be provided for proper lubrication.

Protecting Shop Aisles

By H. L. Bradford

In laying out a large department to handle small parts on a mass production basis, it was found economical, from the standpoint of transportation and material handling, to place the machine operators out of the aisles. This brought the drive belt of the single- and multiple-spindle drill presses into the gangway, and made the maneuvering of lift-type trucks dangerous to the trucker.

After trying out several types of guards, which were either knocked down, or fell because of faulty installation, the self-supporting method shown in the illustration was tried. A piece of angle iron was screwed to the floor, and the upright pipe members were secured to it by U-bolts. The upper ends were secured in a similar manner. The result was a substantial, pleasing guard with no unsightly braces to ceiling, column or machine. This is seen in the illustration.

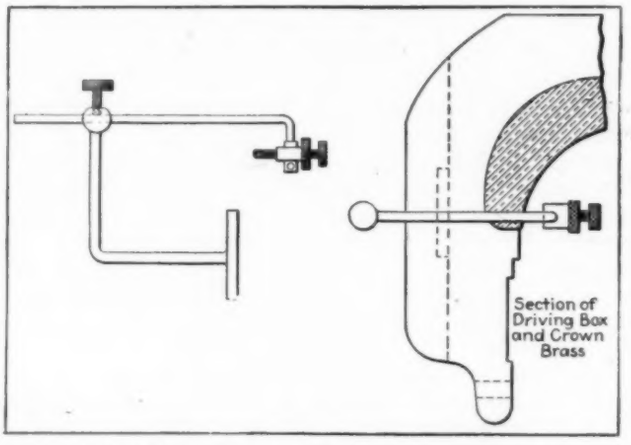
Incidentally, the illustration shows the tooling method used at this plant. All jigs were made so that no wrenches are required, and are fastened to the platen of the machine, as shown at the left. Where the distance between the tool and the part being worked upon is too close to allow of the easy removal of the part, or where more than one drill head is used, guides are fastened to the table and supplied with the necessary stops. This practice eliminates chip trouble, cuts down the idle time, and reduces the drill breakage.

Adjustable Gage for Checking Crown Brasses in Driving Boxes

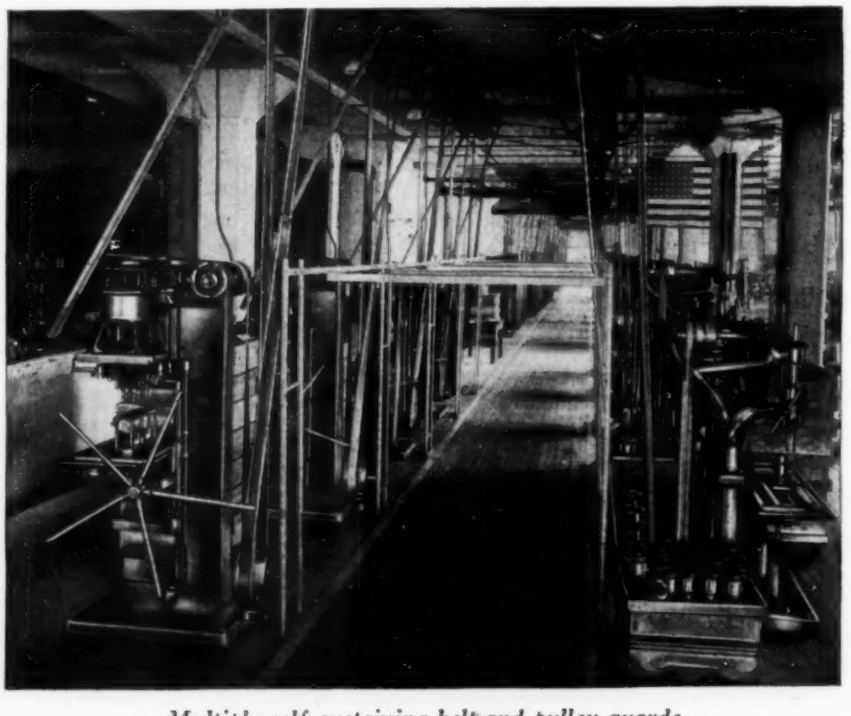
By J. H. Hahn

During the reconditioning of locomotive driving boxes, boring the crown brasses is one of the most important operations. In order to insure that the bores of the crown brasses are central with the shoe and wedge faces of the driving boxes, it is necessary that the brasses be checked closely during the boring operation.

The adjustable gage shown in the illustration was designed to afford more accurate and rapid checking of the driving boxes. With the older type of gage there was no means of adjustment and no means of telling (without measuring) just how much the bores of the crown brasses were out of center, nor how much had to be machined from the "heavy" sides to bring them central. The adjustable gage will indicate these points. If the driving boxes are not machined accurately, the engine will not be "squared up" properly when in service.



Adjustable gage for checking crown brasses



Multiple self-sustaining belt and pulley guards

Characteristics of Silver Solders

Silver solders are high-melting-point brazing solders employed for important joints where strength and resistance to high temperatures and corrosion are important. They are more expensive than common solders and ordinary brazing metals, but are widely used because of their high strength. Typical uses are for joining gasoline and oil lines on airplanes where heavy vibration is encountered, and for the gas piping on electric refrigerators where the prevention of leaks is of utmost importance. Joints made with good silver solders are often stronger than the original metal of the parts.

The range of melting points for silver solders is from 1,300 to 1,600 deg. F. The melting point of pure silver is 1,761 deg. F., but this is lowered by the addition of copper, zinc, and sometimes cadmium. The solders contain a high percentage of copper, which may be considered as the base metal of the solder since the melting point is higher than that of silver. In general, the solders containing high percentages of silver flow at the lower temperatures, though this is not always true as the low melting point may be obtained by larger additions of zinc and cadmium. Silver solders may be considered brasses with the addition of silver as a hardener and toughener, but this designation is not exact because in some cases the silver content may be very high, even reaching to as high as 80 per cent. Some solders may have only copper and silver, while others may contain the four metals.

Grades by Melting Point

Silver solders may usually be obtained in grades according to the melting point, the latter varying in steps of 25 deg. F. The lower melting point solders are generally silvery-white in color, gradually changing to brass yellow in the grades having the higher melting points. The range of melting point should be selected according to the metal for which it is intended to solder, but since the melting point is not a secure guaranty of quality the recommendations of the maker should also be considered. It is often important, also, that the color of the solder match the color of the parts, especially if the latter are made of nickel, Monel metal, or bronze.

A fine quality of "easy flowing" solder, rich in silver, and having a melting point from 1,325 to about 1,450 deg. F., is employed extensively for soldering copper, nickel, and Monel metal tanks, gas lines, radio parts, and airplane fuel and oil pipes. For brass work where the color is to be matched, and where a lower-cost solder is desired, higher melting point solders of yellow color are used. For soldering iron and steel a temperature of about 1,550 deg. F. is required to make a good bond.

The blow torch is always used for silver soldering, since the melting points are too high for ordinary soldering methods. The parts to be soldered should first be heated at and near the joint, the latter being brought quickly to the desired temperature (cherry red to bright red) when the parts are hot. The silver solder is then melted under the flame and caused to flow along the joint. The surfaces to be soldered must be clean and smooth. The joints should fit closely, and be held together firmly while being soldered. Borax is used as a flux, either powdered or mixed with water or alcohol. Both the joint and the solder should be covered with the flux to protect the metal against oxidation.

Temperatures Employed

Care should be used not to overheat the work. The principal metals which are silver soldered begin to melt at temperatures, deg. F., approximately as follows:

Steel	2,500	Bronze (90-10)	1,830
Monel metal	2,480	Low Brass	1,740
Copper	1,980	High Brass	1,630
Nickel silver	1,950	Extruded brass	1,580

The parts should never approach these temperatures, as prolonged heating at high temperatures tends to give a coarse grain and poor structure to the work. For example, Monel metal should not be heated about 1,450 deg. F., although it melts at a much higher temperature.

Silver solder is usually marketed by the Troy ounce in the form of sheet, strip, wire, or filed. The sheet comes in rolls, and the strip in short lengths of varying widths. The usual thickness of sheet and strip is about 0.032 in. Filings, or powdered solder, is sold in cans of varying screen sizes.

A good quality of silver solder produces a joint that is malleable and ductile, capable of withstanding vibration. Resistance to corrosion is a characteristic of all silver solders, which makes them valuable for airplane work, tanks, and dairy and food-products machinery. Silver solders also have the characteristic of uniformity of flow, whereas ordinary brazing metals are apt to show pittings. A silver-soldered joint is therefore considered more reliable and secure against leakage for tank and pipe work. The electric conductivity of these solders is generally higher than that of copper, which makes them valuable for making joints on radio and other electrical parts.

For the data given we are largely indebted to Handy & Harman

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Motor Data for Machine Buyers

FROM two entirely different sources come complaints of expense and delays incurred by a seemingly unnecessary lack of definite information regarding the electric motors to be used with given machines. In one inquiry for five different machines, not a single proposal gave sufficient data to enable an intelligent selection of motors to be made without further correspondence and inquiry. This fault was evidently due to lack of attention on the part of the machine builders.

A second instance put the responsibility up to the motor manufacturer, or his representative, who supplied erroneous information concerning the motor base. This oversight caused delay and direct money loss because the motor bracket, made to the builder's blueprints, did not fit the motor when it was delivered.

In both cases there was probably the desire to do the right thing by the customer. But carelessness as to details, neglect to get full information, and failure to see that salesmen had correct data, worked injury to all concerned. It is a good thing to put yourself in the other fellow's place in such cases and see things from his viewpoint.

Tests that Bring Practical Results

BUILDERS of machines have been between two extremes with conflicting reports on the new cutting alloys. Demands to scrap everything in sight seem to be the favorite indoor sport of some enthusiasts when a radically new improvement in equipment or materials is presented. The *American Machinist* has attempted to show editorially, on page 260, Vol. 70, and on other occasions, that we may be fooling ourselves in this respect. It was pointed out that longer life between grinds, and time saving in resetting, should be the first economies to be realized from the tungsten-carbide cutting tools. This is shown to be an actuality by the results of the Navy tests described on another page.

Right now it seems apparent that shops can use these alloys advantageously with the present design of equipment if good judgment in setting up is used, and if a machine is selected that has some capacity in excess of the actual job in hand. The immediate requirements for machine redesign are shown to be chucks that will bring the work closer to the spindle bearing, better tail centers, and more substantial toolposts. It is just as foolish to say that these new alloys will make high-speed steel obsolete as it was to figure that carbon steel would be made obsolete by high-speed steel. What is required actually is more test data that the machine builder can incorporate practically into his product.

Machine Equipment and Wealth

ACCORDING to Prof. David Friday, a good measure of the wealth of a nation is the proportion of the population required to feed and clothe its people. As some countries do not produce enough of either commodity for their own needs, the number required to produce goods to be exchanged for food, are included among those needed to feed and clothe the nation.

Judged on this basis we have the United States feeding itself with but 24 per cent of the population, leaving 76 per cent to produce other commodities for home use or foreign trade. England, Germany, France, Italy and Russia follow with 35, 40, 50, 65 and 70 per cent, respectively, engaged in feeding and clothing their people, leaving 65, 60, 50, 35 and 30 per cent available for other products.

Stated in another way, fewer men in the United States produce more food and clothing, just as they do of other commodities, the output per man being vastly higher than in some of the other countries. But we must not overlook the fact that this difference in productivity is due more to machine equipment than to inherent superiority of the average worker of any country. For, generally speaking, productivity is almost directly proportional to the machine equipment and the power available per man.

With the increase in improved machine equipment abroad, either by importation or by home manufacture, productivity will grow, both in agriculture and in manufactured commodities. These changes should result in improved living conditions, in greater consumption of products that are now in the luxury class, and in a general bettering of European conditions.

More power per worker and better machine equipment will do much to raise living standards, and improved living conditions mean higher wages and greater buying power.

Cincinnati 24x36-Inch x 28-Foot Heavy-Duty Cylindrical Grinder

IN ITS general appearance, the 24x36-in. x 28-ft. Cincinnati plain, self-contained grinder shown in Fig. 1, resembles the other grinders brought out by Cincinnati Grinders, Incorporated, but several new features have been incorporated in its design. Chief among these is the duplex table that carries the work. This table is made up of two units of unequal lengths, with a total of 28 ft. between centers. When used on a production basis, or shorter lengths, the tables may be uncoupled, the headstock or footstock, as the case may be, transferred to the unit to be used, and the idle part left at one end of the 61-ft. bed.

The forced-feed oiling system is considered an advance over that formerly used, and insures proper lubrication of the table ways on both long and short strokes. This feature, together with the general construction of the duplex table, makes it possible to use one or both tables continuously, without loss of accuracy due to localized wear of the ways. The sliding table receives its motion through a rack and pinion driven from a worm and gear. The shock of reversal is absorbed largely through a shock-absorbing clutch.

The swivel tables accommodate work up to 14 ft. in length without setting over the head or tailstock. They are of the angular type and have their bearings on the sliding table, and are clamped to it at either end. Every lever necessary to the operation of the machine, is within easy reach of the operator.

The base for the wheel housing shown in Fig. 2 forms a housing for a jackshaft, the coolant pump, a part of the cross-feed mechanism, and a power rapid traverse unit. The wheel itself is 36 in. in diameter with a 4-in. face. It is driven by a 30-hp. motor through a jackshaft and a Texrope drive. A flexible coupling still further reduces the vibration that might cause chatter marks on the work. The wheel spindle is mounted upon several preloaded ball-bearings

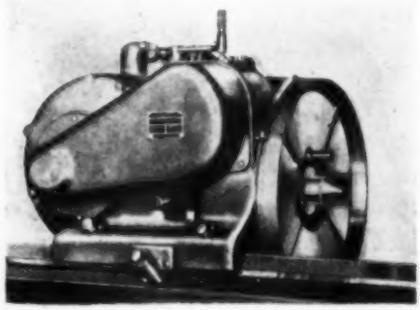


Fig. 3—The headstock is driven through a worm and wormwheel in an oil bath. Backgears provide an additional series of work speeds

of a design that will not cause a strain should the spindle expand. One of the bearings is loaded to 800 lb. by means of a helical spring, which

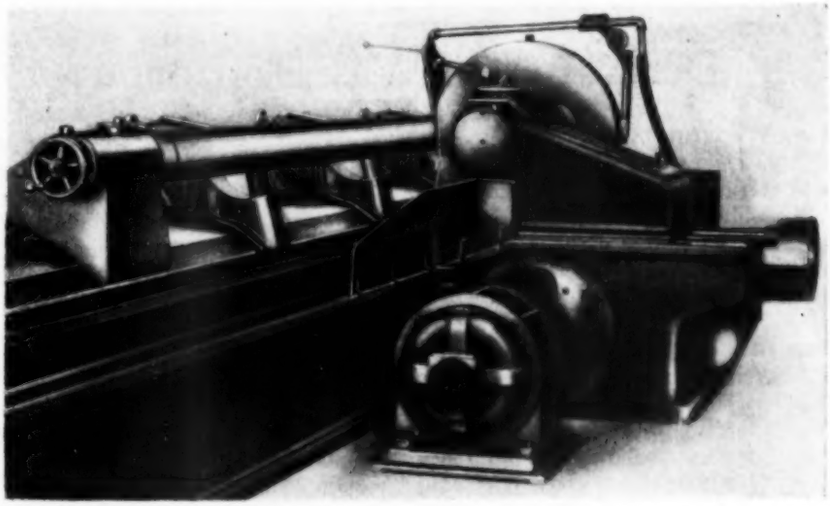


Fig. 2—The wheel housing is shipped separate from the bed. It houses the jackshaft, coolant pump, feed mechanism and the rapid traverse unit. The 36-in. wheel is driven by a 30-hp. motor through a Texrope drive

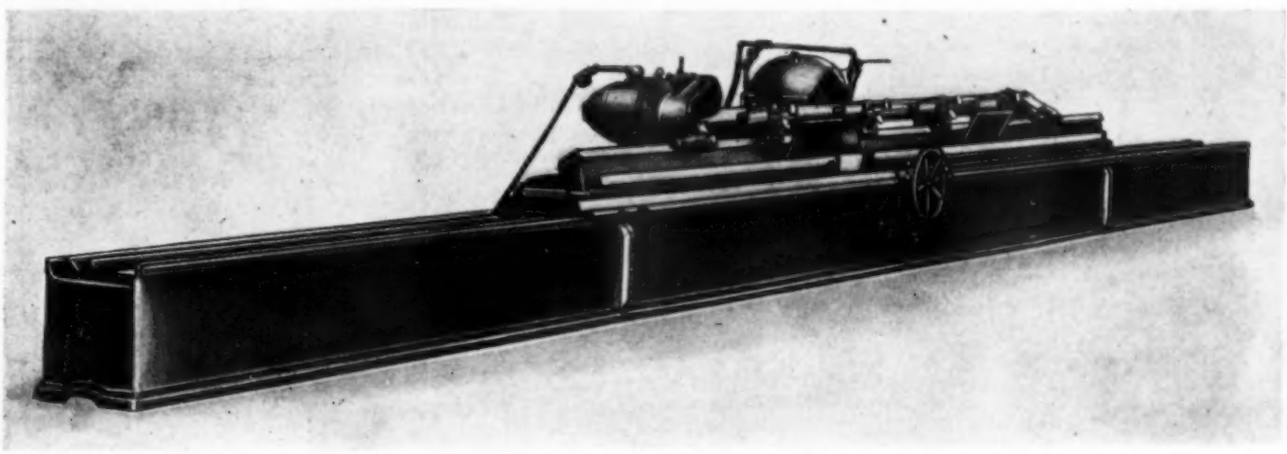


Fig. 1—Cincinnati 24x36-Inchx28-Foot Cylindrical Grinder with duplex table. The bed is 61 ft. long

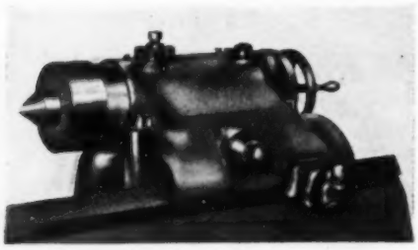


Fig. 4—The footstock is moved by a rack and pinion and is clamped against movement by three bolts

automatically compensates for wear and adjustment.

The power for the rapid traverse of the wheelhead is supplied by a ½-hp. a.c. motor. The traverse is controlled by a single lever, and is automatically disengaged when not in use. The headstock shown in Fig. 3 is driven by a 3-hp. d.c. variable-speed motor through a Texrope drive to a worm and wormwheel running in an oil bath. Backgears provide an additional means of varying the speed of work rotation. The headstock is provided with a rack and pinion to move it along the table, and it is clamped against movement by three bolts.

Where d.c. is not available, it is supplied to the headstock motor by a generator mounted on the rear base, and driven by the main motor, through a ball-bearing jackshaft.

The footstock is of sturdy design and has the same means of moving and clamping as the headstock. This is shown in Fig. 4. The design and size of the machine make it necessary to divide it into several units to facilitate transportation. The front base is made up of three sections, and the rear is separate.

Defiance Two-Way Horizontal Boring Machine

BOTH ends of rear axle housing carriers for farm tractors and other similar work are bored on this two-way horizontal machine shown in the illustration. The machine has been developed by the Defiance Machine Works, Defiance, Ohio. Each head has three spindles spaced in a 29-in. circle and running in Timken tapered roller bearings. The heads are thoroughly inclosed, and are lubricated by a splash-feed oiling system. Each head is driven by means of a 10-hp. motor direct-connected and running at 400 r.p.m. The spindles are driven by means of helical gears.

The fixture is cast solid in one piece with the exception of the clamps, but revolves about the center, and is mounted on roller bearings. There are four clamping positions, one station for loading and unloading, one station for rough boring, one station for semi-boring, and the last station for reaming. Each station is equipped on both sides with hardened bushings for guiding the boring bars. When loaded, the fixture weighs about 10,000 lb. and can be indexed from one position to the other by one man using only one hand. The boring bars used are 7¼ in. in diam., and are inlaid with hardened steel packing strips, which are ground true to a fit in the revolving bushings in the guide housing as well as in the fixture.

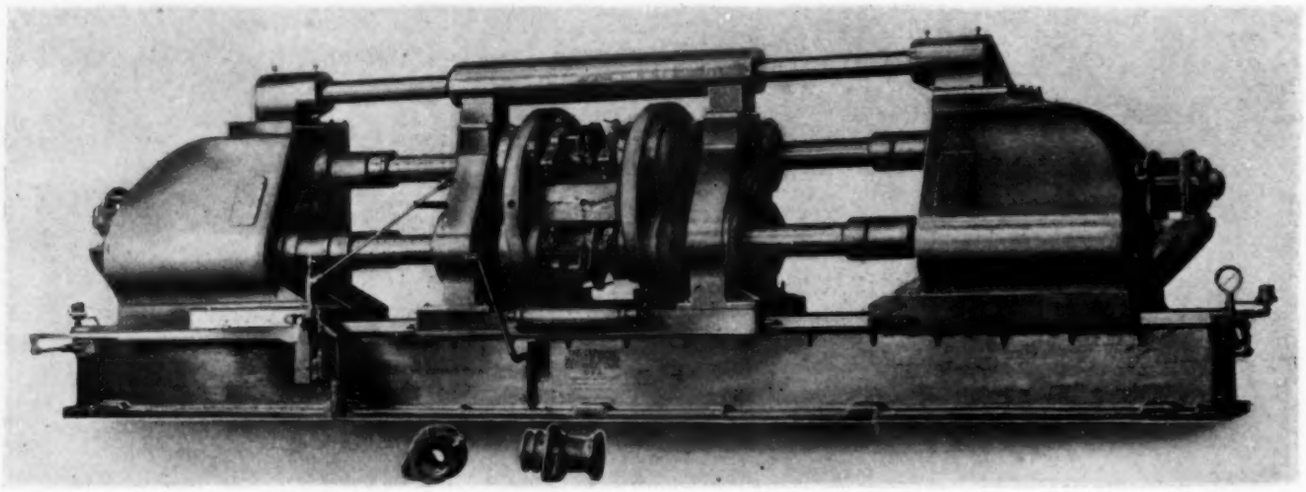
The height from the sliding ways to the center of the fixture is 28 in., and that from the sliding ways to the lower spindle is 17¾ in. From the top of the sliding ways to the upper spindle is 38¼ in. The travel of the heads is 38 in. and the size of the fixture base is 35x89 in. All spindle speeds are 32 r.p.m. Oilgear feed is used on this machine, and can be regulated to suit requirements.

An endless bed conveyor is fitted under the fixture to carry the chips over to the side of the machine. A 3-hp. motor is used for driving the Oilgear pump and a ¼-hp. motor drives the conveyor. Production of finished pieces is quoted at 30 per hour, or one cycle of operation every two minutes.

Floor space occupied is as follows: Length, 26 ft. 6 in.; width, 86 in. The height is 90 in. and the net weight is 56,530 pounds.

"Haskelite" Aluminum and Duralumin "Plymetls"

Aluminum and duralumin faces have been attached permanently to "Haskelite" plywood, by the Haskelite Manufacturing Corporation, Chicago, Ill. These products are known as aluminum "Plymetl" and duralumin "Plymetl." Both of these materials



Front view of the Defiance Two-Way Horizontal Boring Machine used for rough boring, semi-boring and reaming rear axle housing carriers for tractors

combine the strength and light weight of plywood with great resistance to impact, abrasion, and fire. A new glue process developed by this company provides an almost unbreakable bond between the wood plies and the aluminum or duralumin faces. These Plymetl panels have also been adapted to insulating purposes by means of providing them with cores of Balsa wood and other insulating materials between the panels.

Landis Type AB 16-Inch Crankpin Grinder

THE type AB crankpin grinder announced by the Landis Tool Company, Waynesboro, Pa., combines certain features of the type A and type B machines brought out previously. The front portion of the machine is like the front portion of the type A crank grinder, while the rear portion is similar to the rear portion or the type B plain grinder. This combination results in a unit on which all the pins of a crankshaft may be ground without removing it from the machine. Two sizes, 16x32 in. and 16x42 in., are available.

Work spindles are driven through a longitudinal shaft so that both fixtures are rotated in unison, the power being supplied by a 2-hp. motor driving through a worm and worm gear. The final drive to each work spindle is through a silent chain with provion for keeping them under even tension at all times. Crank carrying fixtures with hydraulically operated work clamps are provided, the hydraulic pressure being applied through the work spindles and being controlled by means of a valve within easy reach of the operator. A safety device makes it impossible to rotate the fixtures before the shaft is securely clamped. Depending upon the nature of the current used for the work drive motor, either a dynamic or solenoid brake is provided to prevent the work from drifting, when the work rotation is stopped.

A hydraulic work rest is rigidly attached to the bed of the machine, so that it is directly in front of the grinding wheel, regardless of the pin being ground. The jaws are advanced or withdrawn by hydraulic pressure, but the movement is so controlled that the final adjustment is made by hand adjusting screws. Unless the jaws are in their back position, the work carriage cannot be traversed, making it out of the question for the operator to accidentally jam the work against the work-rest jaws, by traversing the carriage before the jaws are in their back position. On the majority of these machines the rest is arranged in the center to take a gage for sizing the crankpin mechanically.

The crankshaft is located endwise by bringing it against a stud on the side of the indexing fixture plate or bringing the shoulder of the rear bearing against the side of the clamping block. A locating arm, which locates from the center main bearing, is sometimes used. The indexing plate is incorporated into the work-carrying fixture and locates the shaft radially either from the holes in the flywheel flange or from locating lugs on the cheek of the crank. Spacing is accomplished by a rigid bar on which lugs are securely fastened in the proper relation to each other, according to the spacing of the pins on the shaft. A positive stop on the under side of the work table comes against the top lug on the bar, thereby placing the corresponding pin of the shaft in front of the grinding wheel. To eliminate shock and vibration when the carriage traversal stops, a hydraulic cushioning device is attached to the end of the bar.

The diamond holder is held in a bracket clamped in the crank carrying the fixtures when in use. Should a mechanical wheel dresser be used, a similar bracket carries the truing wheel as well as the diamond for truing the sides of the grinding wheel. Necessary oil pressure is supplied by a twin-geared ball-bearing oil pump. One set of gears takes care of the

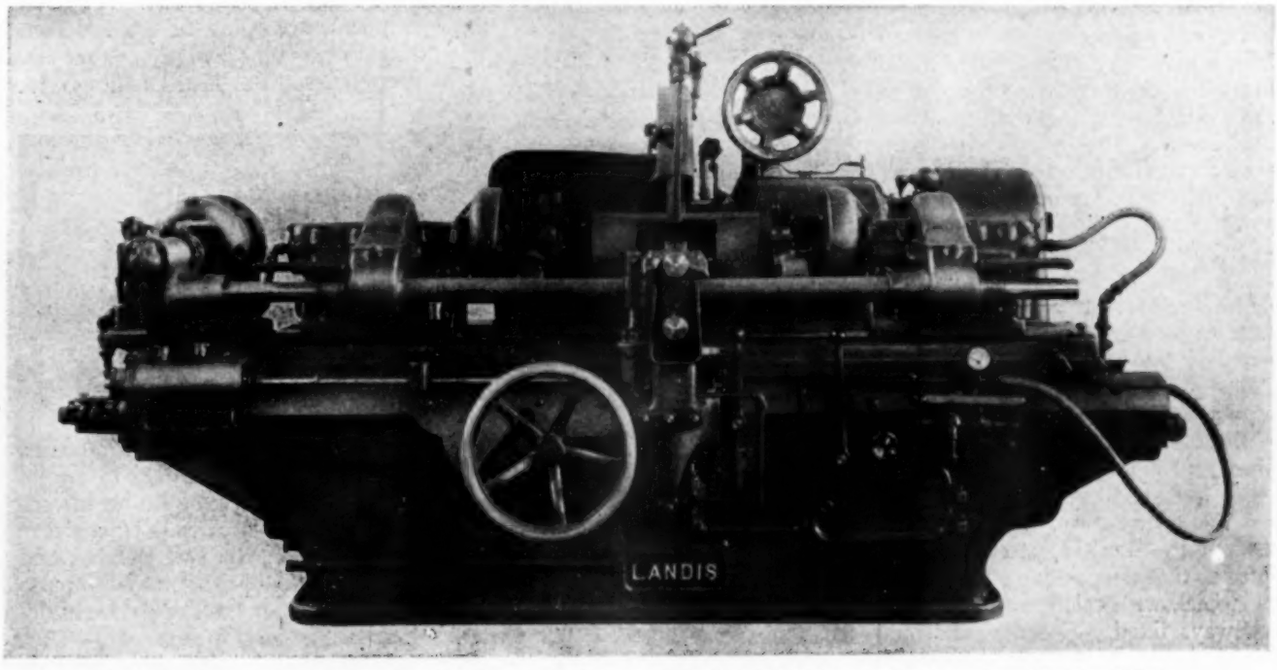


Fig. 1—Front view of the Landis Type AB 16-Inch Crankpin Grinder, which is operated hydraulically

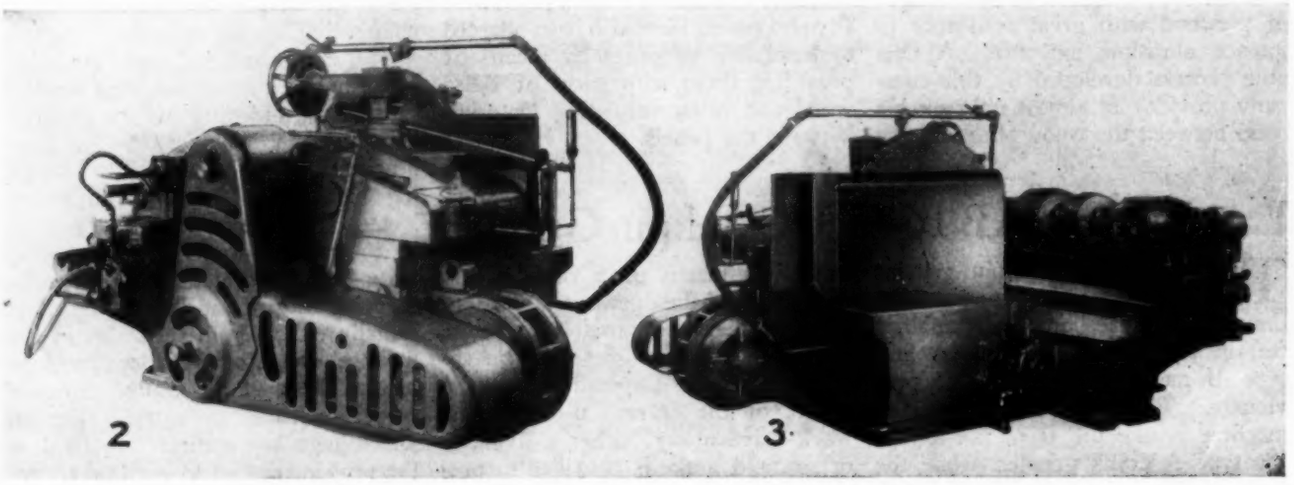


Fig. 2—Left-hond rear view of the Landis Type AB 16-Inch Crankpin Grinder. Fig. 3—View from the rear at the right end of the machine

hydraulic traversing motor, and the other set takes care of the workrest, work clamps and hydraulic wheel feed.

The standard type A paddle-type traversing oil motor, equipped with anti-friction bearings, gives any carriage traverse speed from 12 to 360 in. per min. by means of the manipulation of a control valve. Reversal at any speed without shock is obtained by means of a balanced piston valve.

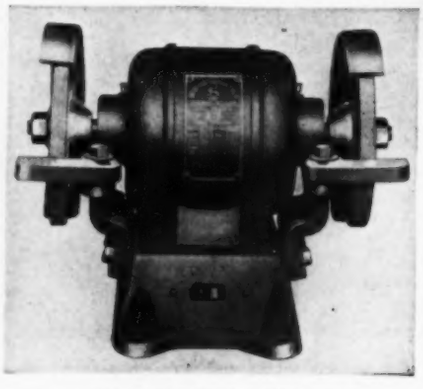
The wheelhead is of massive proportions. It is equipped with a 36-in. grinding wheel, and is carried by a V-and a flat guide with chilled surfaces. Automatic lubrication of these surfaces is made possible by a small pump driven by the spindle direct through a silent gear. Provision is also made for positive thrust bearing lubrication. The alloy-steel wheel spindle is driven from the end, one extra driving pulley being supplied to permit a change of wheel speed in order to compensate for wheel wear.

The hydraulically operated wheel feed is controlled by several levers close to the feed-in handwheel, the speed of the infeed after the wheel comes in contact with the work being regulated by means of a dashpot. With this type of wheel feed, the wheelhead is mounted on a sub-slide, which is moved by means of a piston and cylinder arrangement directly beneath it. Positive stops are provided so that the position of the grinding wheel, with relation to the work, is always fixed. A screw and long bronze half-nut beneath the wheelhead insure accurate and sensitive movement when feeding it by hand.

The main drive motor is of 25 hp., either a.c. or d.c., and is mounted on the rear of the machine, with its pulley directly in line with the pulleys on the wheel spindle and the traverse oil pump. An eight-strand Texrope drive connects the motor and machine. Coolant is supplied by a centrifugal pump located at the left-hand side of the rear portion of the bed, and driven by the traverse oil pump shaft, which extends through the bed from the right-hand side. If the machine is arranged for lineshaft drive, an auxiliary drive bracket is mounted on the bed instead of on the motor.

"U. S." 6-Inch Grinder

Fine and coarse wheels 6x½x½ in. are used on the grinder, which has been placed on the market by the U. S. Electrical Tool Company, Cincinnati, Ohio. The machine illustrated is furnished with adjustable toolrests and complete electrical connections.



"U. S." 6-Inch Grinder

It is driven by a ¼-hp. motor running at 3,450 r.p.m. Other features are the heavy nickel-steel spindle and the ball bearings used for the spindle mounting. The grinder is furnished regularly for 110-volt, 60-cycle circuits, but it can also be furnished for 220-volt, 2-and 3-phase circuits and also in 110-and 220-volt direct current models at extra cost.

Thor "Kick-Out" Nut-Driving Attachment

Correct tightness of every nut driven can be obtained by means of Thor "Kick-Out" Nut-Driving Attachment, according to the Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, Ill.

Thor "Kick-Out" Nut-Driving Attachment

The device is made in several sizes for driving nuts from $\frac{3}{16}$ to 1½ in. The attachment is very simple in construction, and is inclosed by a sleeve extending over the two clutches and thus protects all the moving parts from dust or grit. The device is designed especially for use with Thor high-frequency, 180-cycle, electric tools, because of their power and con-

stant rate of speed, but it can also be used with universal electric tools in various sizes.

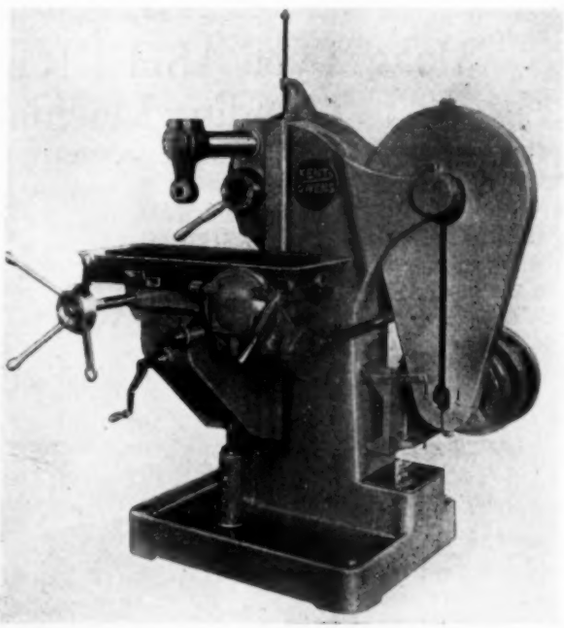
As can be seen from the illustration, this attachment is provided with an auxiliary clutch, which operates under spring tension, when a certain torque is applied to the front end of the attachment. When the nut is driven to the tightness desired, the auxiliary clutch disengages and lifts itself off on a cam, which permits the front end of the attachment to remain stationary for one revolution before the auxiliary clutch is again engaged, during which time the operator has ample opportunity to pull the machine away from the nut. The attachment is adjustable so as to take care of a variety of sizes of nuts and capscrews. This adjustment is very simple.

Kent-Owens Combination Hand and Power Feed Milling Machine

HIGH spindle speeds necessary for small diameter cutters and for milling aluminum, brass and other soft materials, as well as for the use of Carboloy and similar tools, are featured in the combination hand and power feed milling machine, which has been developed by the Kent-Owens Machine Company, 958 Wall St., Toledo, Ohio. The spindle is mounted on Timken tapered roller bearings at the front and rear, thus permitting speeds up to 2,000 r.p.m. The spindle driving pulley is heavy, and is of the balanced flywheel type to eliminate chatter.

A combination manual and power feed arrangement is featured, the operator using either at will. In either case, the quick return is by hand. This permits a rapid traverse of 600 to 700 in. per min., which is stated by the manufacturer to be three to four times as great as for typical power rapid traverses. The star handwheel is used for both the manual feed and the rapid traverse, the power feed being actuated by the lever at the front of the machine. Adjustable trip dogs on the side of the table engage and disengage this feed automatically.

The table, which has a working surface 28 in. long by 7 in. wide and two $\frac{5}{8}$-in. T-slots and a $\frac{5}{8}$-in. center slot, is carried on a column having deep sections, and is thoroughly ribbed throughout. The cross-slide, knee, and table have deep sections and large mating surfaces to insure accuracy, rigidity and long life. The saddle around the table is 35 in. long by 14 in. wide. A special table 50 in. long can be supplied when desired.



Kent-Owens Combination Hand and Power Feed Milling Machine

The maximum distance from the spindle to the table is 17½ in., the vertical feed of the head by the hand lever is 6½ in., and the cross saddle feed is 7 in. Six feed changes are available, and change gears may be mounted to obtain additional feeds. The spindle is supported by a solid steel overarm 3½ in. in diam. and rigidly supported in the head. The under side of this overarm is 4½ in. from the center line of the spindle. The spindle is supplied with the new standard milling machine taper and has a $\frac{3}{4}$-in. clearance hole throughout. Drive may be by either belt or motor. Floor space required is 61 x 74 in. weight is 2,600 pounds.

General Electric Oil-Immersed, Across-the-Line Switch

A small, inexpensive, oil-immersed switch for use in throwing small a.c. or d.c. motors across the line has been developed by the General Electric Company, Schenectady, N. Y. It bears the designation of CR-2690-SY-105. It is a simple device having a minimum of component parts: a one-piece, cast-iron cover, including the switch mechanism, and a small, cast-iron tank for the oil.

The molded-compound switch base carries the stationary contact stud parts, and the moving contact assembly is mounted on another one-piece molded part. The contacts are of the silver-to-silver, double-break type. The use of these contacts and of the molded arm eliminates shunts or drum-type contacts.

The cover is provided with two mounting holes making the switch suitable for wall mounting. Provi-

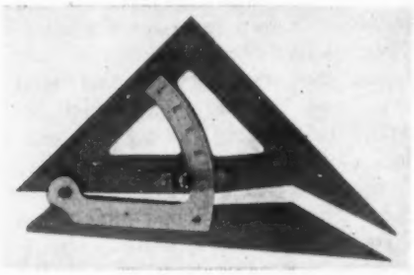
General Electric Oil-Immersed, Across-the-Line Switch

sion is made for conduit connection by means of an incoming conduit box cast into the cover. The molded switch base is bolted to the cover. The cover has a groove, lined with felt, into which the top of the tank

fits, thus providing a tight installation. The tank is held in place by bolts with wing nuts. The handle is of malleable iron.

"New Facila" Universal Adjustable Protractor Triangle

Portability and ability to be used for drawing lines at any angle are the features of the "New Facila" universal adjustable protractor triangle announced by E. S. Brown, Garrow St., Auburn, N. Y. Apart from setting definite angles with the protractor, this device may be used for reproducing lines at haphazard angles, and their complements on all classes



"New Facila" Universal Adjustable Protractor Triangle

of drawings and sketches. The instrument, which is built in 7-, 10-, and 12-in. sizes, does not soil easily.

The stout, transparent celluloid body has a self-centered ivory-grained celluloid protractor of large size, all parts being firmly secured by rivets or screws. The nickel-plated knob locks the protractor positively in any position, also giving rigidity and greatly facilitating picking up and handling the instrument. The annular interlocking hinge provides large bearing surface, insuring smooth action and long life. The engine-divided protractor has large half-degree divisions. Another feature of the device is that the narrow piece may be laid against a T-square and the right angle swung about it for drawing right angles in any position.

Gardner No. 3-CB Polishing Lathe

Multiple V-belt drive is used on the No. 3-CB polishing lathe, which has been placed on the market by the Gardner Machine Company, Beloit, Wis. The spindle is driven through V-type multiple belts by a motor mounted on a bracket cast integral with the machine base. Adjustment for varying the belt lengths is provided, and, in the case of belt breakage, replacement can be made in a few minutes without disturbing the spindle bearings. The belts and sheaves are completely inclosed.

The motor furnished regularly in this lathe is of the inclosed, fan-cooled, ball-bearing type and can be supplied in 5-, 7½-, and 10-hp. sizes. By using sheaves of the proper diameter, any desired spindle speed may be obtained. The spindle is large, 2¼ in. at the bearings and 1¼ in. at the arbors to take polishing wheels up to 3½ in. thick. Double-row Timken adjustable bearings are used at each end, and are mounted in dustproof cartridges, so that the entire spindle assembly can be removed as a unit. The semi-projecting type of base gives a

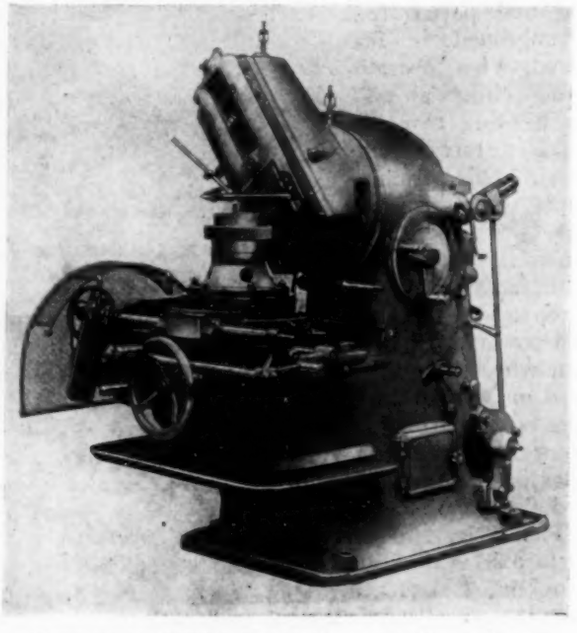
Gardner No. 3-CB Polishing Lathe

slight overhang to the spindle, providing ample clearance across the front of the machine for long work. Other features are the safety spindle nuts and handy push-button control station.

Maag Type ASH-1 Rapid Gear Grinding Machine

ROUGHING and finishing of change wheels for automobile gearings is one of the jobs that can be done on the Maag Type ASH-1 Rapid Gear Grinding Machine, introduced in the United States by the Niles Gear Company, Division of the Niles-Bement Pond Company, 111 Broadway, New York, N. Y. The machine illustrated was especially constructed with an increased number of strokes for the cutter slide. Nine cutting speeds are provided. Change gears are all hardened and ground, and are built into the body of the machine. The required speed can be obtained by operating two handles. Fifteen different speeds can be obtained by means of a screw, while the machine is running.

The largest size spur gear that can be cut is 350 mm. (13.25 in.), and the maximum width is 90 mm. (3.4 in.). The maximum pitch is 6. For the pressure angles of 15, 30, 45 and 90 deg., the maximum diameters of the blanks which can be cut are 280 mm. (7.6 in.), 230 mm. (8.75 in.), 200 mm. (7.6 in.), and 170 mm. (6.4 in.), respectively. The maximum widths for these pressure angles are 85 mm. (3.25 in.), 75 mm. (2.85



Maag Type ASH-1 Rapid Gear Grinding Machine

in.), 60 mm. (2.25 in.), and 50 mm. (1.9). The maximum stroke of the tool is 110 mm. (4.2 in.). The tool is in its highest position at 315 mm. (12 in.) above the table, and the adjustment is 200 mm. (7.6 in.). The floor space required is 68x45 inches.

Davey Portable Dynamic Balancing Equipment

BY MEANS of the stroboscopic principle, apparatus known as the Davey Dynamic Balancing Equipment, which weighs only 20 lb., can be used for determining separately the static and dynamic unbalance existing in machines ranging in size from turbines down to fractional-horsepower motors and correcting both types of unbalance in turn. The apparatus is being manufactured by the Electrocon Corporation, 6 Varick St., New York, N. Y., under the patents of Vibroscope, Inc. In Fig. 1 are shown the three parts, the hand lamp, which contains a special neon tube is at the left, the phase adjuster is in the center, and the Davey "Vibrometer" is at the right. All three can be packed in the convenient carrying case.

The performance of the equipment

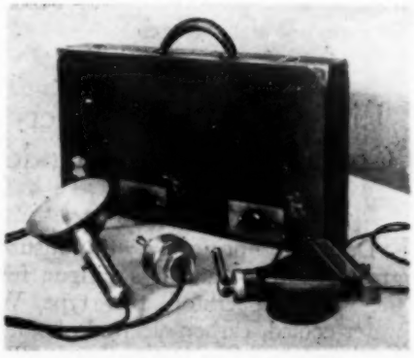


Fig. 1 — Davey Dynamic Balancing Equipment removed from the case. From left to right the parts are: Hand neon lamp, phase adjuster, and "Vibrometer"

can be summarized as follows: (1) Accurate and dependable "high spot" indications regardless of the condition of the shaft, (2) convenient readings of the amount of vibration, fractional parts of 0.001 in. being ascertained easily, (3) a quick method of determining the condition of unbalance in the first run, (4) separate identification of static and dynamic unbalance and separate correction, and (5) close determination of the angle of lag between the high spot and the heavy spot, which causes the vibration. Therefore the equipment may be used where: (1) It is advisable to balance a rotor running under its own power, (2) when it is advisable to balance at a speed higher than that of the available balancing machine, and (3) where a rotor has become unbalanced in service, but it is inadvisable to dismantle the machine. It is also applicable to production balancing before assembly.

In Fig. 2 the apparatus is shown set up for testing the unbalance of an electric motor and determining the position and amount of the resulting vibration. When the rotor is illuminated by light flashes from the neon hand lamp, it appears stationary no matter what its speed. The phase adjuster head is attached to the shaft or driven by the shaft the same as a tachometer. The phase adjuster in the head regulates the light flashes so that rotor will appear stationary at any desired point. The Vibrometer arm is placed in contact with the machine frame at any point and indicates not only the amount of vibration, but also the position of the frame in its path of vibration with respect to rotor in its revolution.

Machine Vibration Measured

The vibrations of the machine, transmitted through the arm of the Vibrometer, cause a small mirror within the instrument to oscillate. Light from an incandescent lamp is thrown on the mirror, and is then reflected on to a scale magnified several hundred times. The scale is graduated in thousandths. Red light from a neon lamp, which is also controlled by the head is also thrown on the screen and impinges on the band of white light. As the phase adjuster is turned, the red band from the neon lamp will assume different positions along the band of light. When it is at the extreme right, it indicates that the motion of the machine is towards the Vibrometer.

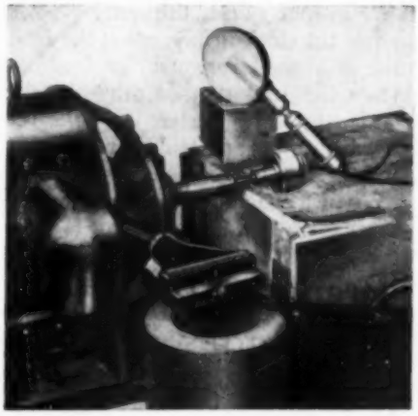


Fig. 2—Davey Dynamic Balancing Equipment set up on a motor to determine the static and dynamic unbalance

Thus it is possible to determine the exact position of the machine in its path of vibration, and to establish the connection between this and the position of the rotor, it is only necessary to light the hand lamp. Thus the high spot can be determined accurately.

By observing the motion of the red light beam on the Vibrometer scale, while the rotor is in process of slowing down from its normal speed, a very close estimate of the angle of lag can be made. By taking high spot readings at various points along the machine, the static unbalance can be separated from the dynamic unbalance, and each of these conditions can be corrected separately.

"H & G" Feed Pusher for Multiple-Spindle Automatic Screw Machines

A feed pusher for multiple-spindle, automatic screw machines has been developed by the Eastern Screw Machine Corporation, New Haven, Conn. The pusher is composed of two principal parts, the master which fits on the end of the customary feed tube, and the inner pusher which is installed inside of the master. A taper on the inside of the master corresponding with the taper on the

"H & G" Feed Pusher for Multiple-Spindle Automatic Screw Machines

inner pusher causes the inner pusher to grip the stock firmly, when the feed tube is pushed forward for feeding. When the feed tube is drawn backwards, the inner pusher is in the released position and slides freely over the stock.

When a machine is once equipped with a set of masters, it is only necessary to change the inner pushers when changing from one size of stock to another, the master remaining as a permanent part of the machine. The advantages claimed by the manufacturer are a positive grip and positive release, and uniform feed.

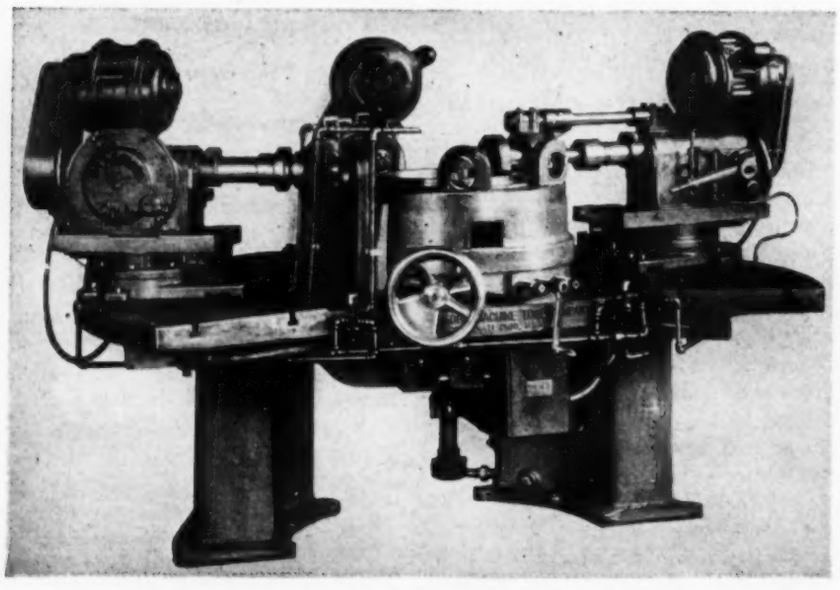
Bradford Drilling and Tapping Machine for Radial Airplane Engine Crankcases

ADAPTED to the rough and finish boring and tapping of 5-, 7-, and 9-cylinder crankcases for radial airplane engines, this three-way drilling and tapping machine has been developed by the Bradford Machine Tool Company, 657 Evans St., Cincinnati, Ohio. The fixture on this machine is provided with a triple index control, and each unit is mounted on a swivel-type block in order to permit the necessary adjustments required to produce the various size crankcases on the same machine. Each unit is controlled independently by means of the hand valves on the front of the machine.

Rough boring is done at the operator's right hand, using multi-diameter boring tools having a maximum diameter of 2.274 in. The finish boring is done at the back of the machine, using tools of a maximum diameter of 2.290 in. Tapping takes place at the operator's left hand, where a $2\frac{3}{8}$-in. thread is produced. All of these operations are performed on nickel-aluminum crankcases.

In the operation of the machine, one part is locked into the fixture. The operator then trips the hand valve at his left hand, causing the first unit to operate. The fixture is then indexed to the next station, and the operator trips hand valves connecting units 1 and 2, thus performing rough boring and finish boring operations on the second cycle. The fixture is then indexed to the third station and the operator trips the three hand valves operating all units for rough boring, finish boring and tapping. These cycles are repeated until all operations have been completed.

A duplex system is provided for the distribution of cutting lubricants, using kerosene on the boring tools and lard oil on the taps. Actual time for a single cycle is 22 seconds. Floor to floor time for the 5-, 7- and 9-cylinder crankcases is 4, 5 and 6 minutes.



Bradford Drilling and Tapping Machine for rough boring, finish boring and tapping the exhaust ports on radial airplane engine crankcases

"Durex" Oil-Retaining Bearings

About 20 per cent of oil by volume can be absorbed in "Durex" bearings, which have been placed on the market by the Moraine Products Company, Dayton, Ohio. This feature is made possible by the porous nature of the material, thus giving a reservoir of lubricant to be used before the bearing becomes dry. The maker insists, however, that these bearings are in no sense oilless bearings, and wishes to avoid all claims of such qualities. It is assumed that they are to be oiled with fair regularity, but, should they be neglected for long periods, sufficient oil is stored up to prevent damage unless the neglect is of too long duration.

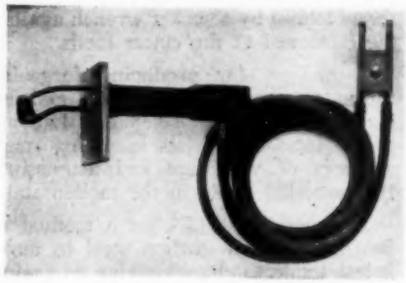
Durex bearings are produced from a mechanical mixture of powdered copper, tin, and graphite by compressing it in molds of suitable sizes and shapes. The bearings can be used ordinarily without machining. They can be made for sliding as well as rotating surfaces, but in all cases the makers insist on studying the service required before supplying them, so as to prevent disappointment should they be used in situations to which they are not well adapted.

Lincoln Type W Water-Cooled Carbon-Electrode Holder

Designed primarily to insure greater comfort and less fatigue for the welder operator, this type W water-cooled, carbon-electrode holder has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio. The device is intended to be used for heavy-duty manual welding by the carbon-arc process. By its use, it is possible to weld with the arc tip of the carbon electrode projecting less than 3 in. from the holder.

One of the features that contributes to the light weight of the holder is the use of the hose to carry both water and the cable. Each of the two water tubes contains a small light cable running from the connector to the holder. The water flowing through the holder also acts as a cooling agent for the cables.

The electrode holder consists of



Lincoln Type W Water-Cooled Carbon-Electrode Holder

coiled copper tubing through which water circulates constantly, the carbon electrode being inserted through the coil. The device is manufactured in sizes for use with $\frac{1}{4}$-, $\frac{5}{16}$-, $\frac{3}{8}$-, and $\frac{1}{2}$-in., carbons. A handshield of compressed magnesium protects the operator's hand from the rays from the arc. The water cooling system is incorporated also in the hand grip of the holder.

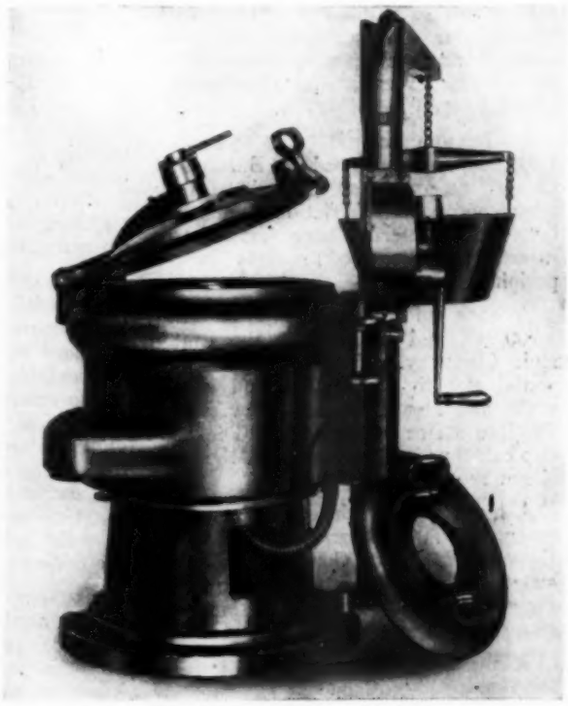
Barrett Centrifugal Oil Extractor, Washer, and Dryer

The line of self-contained, motor-driven centrifugal machines for extracting oil from chips and for washing and drying machine parts, which is built by the Leon J. Barrett Company, Worcester, Mass., has been redesigned and another size added. The line now comprises three sizes as follows: No. 252, having a pan diameter of approximately 18 in. and a capacity of 1,440 cu.in.; No. 502, having a pan diameter of 23 in. and a capacity of 3,720 cu.in., and No. 1,200, having a pan diameter of 30 in. and a capacity of 7,500 cubic inches.

As compared with the earlier machines, the motor unit has been redesigned and provided with a powerful ventilating fan, which keeps the motor cool under all conditions. The motor unit is built by the above company, except for the rotor and stator, which are supplied by a motor manufacturer. Motors are available at different speeds to suit conditions according to the work to be handled. By varying the speed, sufficient centrifugal force is obtained for the purpose required.

Two spindle constructions are now made. The machine is so arranged that a bowl is fixed to the end of the spindle, and a variety of comparatively-light, plain or perforated containers can be fitted directly into the fixed bowl. The pans are provided with two lifting hooks, and are easily handled by the hoist. A quick-acting light cover has been provided, which is easily locked and unlocked, and is held positively in the locked position. A suitable hoist for facilitating loading and unloading has been designed for all sizes of the machine. For the larger sizes, on very heavy loads, a hoist may be supplied for either hydraulic or air operation. The machine is supplied regularly without a hoist, but all machines are arranged to be fitted with one if desired.

The starting switch and safety locking arrangements have been improved and relocated to interlock, so that the machine cannot be started unless the lid is closed and locked. Neither can the lid be opened without stopping the machine, cutting off the current, and unlocking the lid. A rack is provided on the side of the unit for hanging up the cover shown.

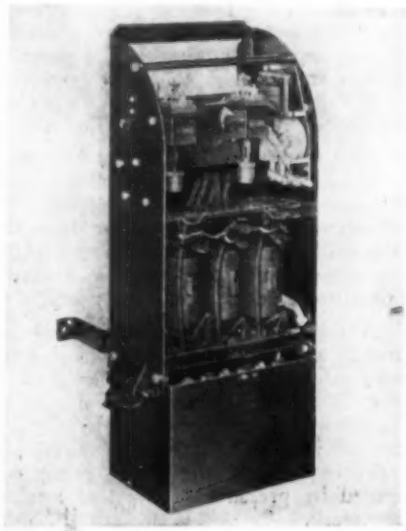


Barrett Centrifugal Oil Extractor, Washer, and Dryer

As a whole, the design of the machine provides for convenient and speedy operation since the suspension of the rotating unit has been rearranged to absorb all vibration. The unit may be adapted for extracting oil from chips, for washing machine parts, for drying machine parts, or as a combined washer and dryer. According to the manufacturers, it may also be used for enameling, lacquering, painting, or coating metal parts, and for numerous other operations where centrifugal action can be applied.

General Electric Compensator for Use in Gaseous Atmospheres

To meet the demand for a hand-starting compensator for use in places where there are explosive gases or gasoline fumes, the General Electric Company, Schenectady, N. Y., has placed on the market such a device, bearing the designation CR-1034-N-52. This is a modification of standard equipment so designed as to eliminate exposed arcing, thereby preventing any possibility of an explosion in a dust-laden or gaseous atmosphere.



General Electric Compensator for use in gaseous atmospheres

The starting switch on this device is oil-immersed. In addition, the usual push-button tripping device is not included in the equipment but, instead, a standard time-delay undervoltage attachment and dashpot relays are used with Cooper-Hewitt mercury tubes substituted for the usual con-

tact tips of the dashpot relays. As a result of this arrangement, exposed sparking or arcing at contacts is eliminated.

The compensator is available for use with motors operating on 25- to 60-cycle, two- or three-phase circuits in sizes as follows, 15 hp. and less—110 volts, 125 hp. and less—220, 440 and 550 volts.

: REVIEW : OF : RECENT : PATENTS :

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

An automatic annealing furnace was patented, 1,699,784, and assigned to the Westinghouse Electric & Manufacturing Company. It comprises a fixed annealing chamber, a removable cooling hood, and a means for supporting the material and moving it into the hood.

A complete lubricating system for a shaper, incorporating redesign of the machine, was patented, 1,699,816, and assigned to the American Tool Works Company. It covered a primary lubricant reservoir, a secondary reservoir, and collecting reservoirs in the bottom and rear of the frame. Separate lubricant distributing passages are provided to each bearing and guide. The pump is located in the lower collecting reservoir, from whence the lubricant is forced up to the top reservoir for distribution.

The American Tool Works Company was assigned a patent 1,699,493, covering a means for feeding drilling machines. It comprises a power drive for the drill head, the latter being capable of both rotation and lengthwise movement on the drill arm.

A portable electric tool adapted for use as a screw driver, wrench or drill, was patented, 1,699,870, and assigned to the Black & Decker Manufacturing Company. It comprises an electric motor driving through a positive overload-releasing clutch, the latter being engaged by pressure of the tool against the work.

The Electric Furnace Company was assigned a patent, 1,699,955, on a conveyor for heat-treating furnaces. It includes a hearth provided with channels to receive the work and reciprocating bars for moving the articles.

An unusual patent, 1,700,221, was one on a welded frame for punch presses and shearing machines. It was assigned to the Kent-Owens Company, and comprised a base of parallel plates having the spacing plates welded continuously about the sides and press opening so as to make a substantial unit.

A patent, 1,700,327, on a relieving mechanism for lathes was assigned to the Pratt & Whitney Company. The cutting tool is mounted on a cross-slide on the carriage, and the work spindle is oscillated by a crank while being rotated. Another patent assigned to the Pratt & Whitney Company, 1,700,340, covered a work-releasing device for lathes. It comprises a means of bringing the tool back and automatically disengages the work from the chuck.

A patent, 1,700,382, on an elevating truck, assigned to the Lewis-Shepard Company, covers a truck with a mechanism for elevating the load and for cushioning the descent. The load can also be supported and locked in an elevated position.

Parts and Mechanisms

Two patents, 1,699,746 and 1,699,747, were assigned to the Simonds Saw & Steel Company on inserted-tooth saws. The saw teeth are inserted in undercut notches held in by tapered keys or by tapered pins and transverse pins.

A drill chuck for a flat drill was patented, 1,699,837, and assigned to the Nande Corporation. The chuck has an off-center transverse slot. The bit is special, and is held by set screws in the smaller jaw.

Patent 1,699,851, on a welding torch was assigned to the Imperial Brass Manufacturing Company. The torch has exterior and interior passages, the exterior passage opening both to the tip and to an expansion chamber for mixed gases.

A friction clutch was patented, 1,699,968, and assigned to Bardons & Oliver. It comprised a clutch with internal and external friction cone members. The internal cone has friction inserts in dovetailed sockets in its periphery.

A hook rule, or scale, was patented, 1,700,245, and assigned to the Lufkin Rule Company. The clip has a horizontal slot to receive the end of the scale, and also a headed screw, which fits into a slot in the scale. The hook clip can thus be detached from the scale if not required.

A mounting for abrasive wheels was patented, 1,700,331, and assigned to the George W. Perks Company. It consisted of clamping plates made to fit the irregularities in the wheel sides and clamped by a nut on the shaft end.

A method of locking the teeth of large-inserted-tooth cutters was patented, 1,700,333, and assigned to the Pratt & Whitney Company. It covered a cam screw locked by a socket wrench against the front end of the cutter tooth.

A process for producing forgeable nickel was patented, 1,700,460, and assigned to the Bell Telephone Laboratories, Inc. It consists in adding small amounts of vanadium and magnesium to the nickel while in the molten state.

A patent, 1,700,674, on a method of heat-treating low-carbon steel to make it less liable to change owing to ageing and less liable to destruction of texture by the influence of liquids or gases, was assigned to Fried. Krupp, A.G., Essen, Germany. It comprises a process of quenching the steel at a temperature above 650 deg. Centrigrade.

Trade Publications

ALLIGATOR SHEARS. The Canton Foundry & Machine Co., Canton, Ohio, has published a catalog showing its line of all-steel shears equipped with machine-cut steel gears and pinions. Each size is illustrated and the specifications are listed. The catalog contains nineteen 11x8½-in., pages.

ADJUSTABLE DRIVES. The Reeves Pulley Co., Columbus, Ind., has published a booklet entitled, "The Modern Need for Infinite Speed Adjustability," illustrating the use of its adjustable drive in the factories of fifteen nationally known manufacturers of diversified products. It also describes the methods by which these manufacturers have solved problems in speed regulation.

ELECTRIC TESTING. The Wagner Electric Corporation, St. Louis, Mo., has just issued the fourth edition of its manual of electrical testing, a 20-page bulletin on testing single and polyphase motors and testing transformers for core loss, copper loss, polarity, insulation, temperature rise, and efficiency. The manual is known as Bulletin No. 138.

FEDERAL STANDARD STOCK CATALOG. The Chief Co-ordinator, Washington, has prepared the "dummy" of a Federal standard stock catalog, which will soon be available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. The dummy contains a brief description of the catalog and sample pages of its various sections. While prepared primarily for Government service, it is believed that its usefulness can be extended to the commercial field.

TEXROPE DRIVES. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has published bulletin No. 1228-H on Texrope drives as applied to several kinds of machinery. Photographs of many applications are included. The catalog contains fifteen 11x8½-in. pages.

News of the Week

Corrosion Featured at Mining Engineers Annual Meeting

One whole day was given up to a corrosion symposium by the Institute of Metals Division of the A.I.M.E. at the Annual Meeting of the Institute held at the Engineers Societies Building in New York, February 18 to 22. Twelve papers dealing with various aspects of the problem were presented at the morning and afternoon sessions at which Dr. Paul D. Merica, of the International Nickel Co. acted as chairman. The Wednesday sessions of the Institute were also of particular interest to the metal-working industries with papers on nickel, copper alloys, high-strength brasses, and the heat-treatment of Muntz metal. An interesting paper by J. L. Gregg and C. W. Wilson on a metallographic study of the new tungsten-carbide cutting metals showed a decided difference in makeup and probable wearability of different brands of these alloys.

HEAT-TREATMENT OF BRASS

The heat-treatment of brasses and bronzes containing nickel and silicon was taken up in a paper by W. C. Ellis and Earle E. Schumacher. The paper discussed the hardness and mechanical properties of various of these alloys, and the effects of quenching and aging. The effect of cold-rolling on the hardness and tensile strength was also discussed. The change in properties by changing the content of bronzes was also shown.

Muntz metal heat-treatment was discussed in a paper by L. Russell van Wert. This 60-40 brass was shown to be capable of giving varied properties by quenching.

The paper on the corrosion of tin and its alloys, by C. L. Mantell, was exhaustive, and contained much data of value from the standpoint of the metal-working industries. The effects of various acids and of exposure were discussed in detail. Other papers on the subject of corrosion were: "Resistance of Copper-Silicon-Manganese Alloys to Corrosion," by H. A. Bedworth; "Some Aspects of Corrosion Fatigue," by T. S. Fuller; "Weather Exposure Tests of Sheet Duralumin," by Henry S. Rawdon; "Corrosion of Metals as Affected by Stress and Time," by D. J. McAdam, Jr.; and "Some New Developments in Acid Resistant Alloys," by Burnham E. Field.

The interest displayed and the number of papers presented on the properties of metal from the standpoint of the users are indications of the general interest throughout industry of the importance of the proper selection of metals and alloys to meet the needs of manufacturers in bettering their products. Other sessions of the program of the meeting were devoted to the metallurgy of metals and ores, and various aspects of mining methods.

Navy Tests of New Cutting Alloys

Official tests made at the Philadelphia Navy Yard on Feb. 11 showed the possibilities of tungsten-carbide cutting tools, when working under average shop conditions. "Carboloy" tools, furnished by the Carboloy Co., were tested, and the tests were carried out under the direction of officers of the Bureau of Engineering of the U. S. Navy. Representatives of ship-building and steel companies and of the *American Machinist* were present.

An all-day test of a Carboloy roughing tool on the cutting of a nickel-alloy steel forging demonstrated superior wear ability and great saving in grinding time over previous records of the shop in the use of high-speed steels. Manganese steels, containing approximately 14 per cent of manganese, which have been considered as unmachineable, were also turned in a standard lathe with the Carboloy tools. Remarkable results in tool life and speed of cutting were shown in the turning of manganese bronze, a material that is much employed in Naval construction. Minor tests were also made in the machining of hard rubber, Bakelite, mica, and glass.

McGraw-Hill Editors to Visit South

Rapid growth of the new industrial South is responsible for the decision of a group of executives and editors of the McGraw-Hill Publishing Company, publisher of the *American Machinist* and other engineering, industrial and business papers, to visit important southern manufacturing centers in the first two weeks of March. The visiting editors will represent a group of publications, which are intimately in touch with southern business expansion, and which maintain regular correspondents in southern cities.

The party will leave New York on Sunday, March 3, and proceed first to Charleston, West Virginia. From that city they will move to Richmond and thence to Greensboro, North Carolina. After Greensboro, the itinerary will include Winston-Salem, High Point and Charlotte. Then the executives and editors will go to Greenville and Spartanburg. After that, Savannah is the next city in the itinerary. Then will follow Atlanta and Birmingham. From that city, the visitors will enter the state of Tennessee, closing their itinerary with Chattanooga, Kingsport and Elizabethton.

The full sweep of industry in the South will be studied by the fifteen men who will make up the publishers' party. Plants devoted to textiles, chemicals, steam and electric power generation, naval stores and other basic products will be included in the list of developments to be seen. Chambers of Commerce and individual industrial leaders at points included in the itinerary will co-operate in the plan to enable the visiting editors to gain a first-hand and up-to-the-minute view of southern industrial activity.

Trade Mark Conference Agreement

One of the most annoying sources of difficulty encountered by American manufacturers in trading with South American countries will be removed by the final adoption of the Pan-American trade mark agreement, which was signed by the conference in Washington on Feb. 20.

The trade mark treaty as outlined by the Pan-American Trade Mark Conference will grant to the citizens of all American republics, which ratify the treaty, the same rights and recourses which their laws concede to their own citizens. Every trade mark duly registered in one of the contracting countries will be admitted to registration and legally protected in any of the other contracting states. This agreement, when ratified, will do away with the considerable amount of trade mark piracy that has been practiced by individuals in the past in countries where priority of registration has been recognized. American manufacturers have in numerous instances been prevented from marketing their products under the American trade name in certain Latin countries, because of previous registration by unauthorized persons.

Heavy Car Inquiry

The heaviest volume of car inquiry in some time is being received by the freight car builders. More than 21,000 cars are being quoted upon, and tentative figures are out on many thousands more. Orders for over 10,000 cars have already been placed.

BUSINESS BAROMETER . . . . *Industrial activity continues high, but stock market deflation without injuring business is still the problem*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE Reserve Banks are going busily about their work of repairing fences against the escape of Reserve credit into stock market uses, and until the job is completed and it is seen how effective are the barriers erected, business will continue to sit on the anxious seat.

The Banks are selling government securities and reducing their holdings of acceptances, both of which act as reserves upon which ten to fifteen times their amount of member bank loans may be based. They are raising acceptance buying rates in all the Banks as a support to the efforts of the New York Bank to curtail credit. And presumably, they are exerting their considerable powers of persuasion to keep rediscounting at a minimum.

While they are carrying out these measures, the issue, so far as it will affect business during the second half of this year, is clearly joined. Admitting the existence of an inflation of credit whose effects have been confined to the stock market, the question is whether a deflation can be effected which will be also localized.

If that could be done, business men who are sticking to their knitting would need to feel little concern. But it is unlikely that business and the stock market can be so carefully put into separate compartments. The dear money, that is the consequence of the Reserve policy, unfortunately will affect business more than it will the stock market, which during the past year has often demonstrated its indifference to the cost of money as long as business news supplied a pretext for marking up prices.

Thus the question is broadened to this: Will the Reserve authorities carry their policy to the end of stopping stock speculation in the surest way that it can be stopped, which is through a moderate recession in business? Or will their efforts stop short of this "bitter end?"

If they elect the former course, over the protests that Congress is already making, such a recession is probably not far ahead, since building is already lagging a little. But if the Board stops short of its full powers—if, as is said of a prizefighter who hits softly, it "pulls its punch"—half-way measures may prove ineffectual, and the stock market advance may be resumed and continued until commodities also are gathered up in the inflationary movement.

With so much depending upon events still to be disclosed, it is difficult to speak of the outlook with any finalty. But the action of stocks last week indicated that the market, reassured by failure thus far to raise the New York rediscount rate, thinks the Board may "pull its punch." Prices advanced a little each day before the holiday. Except for the prospect of firm money the business news was all reassuring.

IF THE problem of getting skilled mechanics could be solved satisfactorily the machinery manufacturers of the country might be considered as in a very nearly boom period. Sales of machinery are general and well diversified throughout the country, and not dependent on the automotive or any one business. The difficulty of obtaining skilled workmen has turned manufacturers to calling for automatic machines and high-speed tools in preference to making enlargements of their plants. Unskilled labor is plentiful in all fields, and unemployment of this class of help is probably higher than it was several months ago.

NEW ENGLAND machinery builders are more active. The ball-bearing manufacturers have a rush of orders, and the machine-screw and parts plants are doubling and trebling production. The aeronautical industry anticipates three motors required for every two planes, and builders are adding equipment and men.

IN THE Detroit, Cincinnati, and Cleveland districts employment conditions are better, inquiries for machine tools are well diversified and general, and the automobile sales prospects continue favorable. Milwaukee, and the western area, have much the same difficulty with a shortage of skilled men as is apparent in the East. The railroads throughout the country continue to buy some machinery equipment, but there is no indication of a general movement toward modernization of shops as is found in industrial plants in general. The makers of road-building equipment and of agricultural implements are buying machinery in anticipation of a good year.

The Baltimore & Ohio and the Nickel Plate railroads have submitted to the Interstate Commerce Commission applications to consolidate other roads to form two of the projected four new Eastern trunk line systems. This is but one more move in a chess game that has lasted for many years and will be continued for several years longer, but each important move seems to incite fresh advances in the shares of one or more of the roads affected.

Export of a million dollars in gold from Argentina to this country and reports that a large shipment from Canada has been arranged support the prediction of those who believe that, because high money rates check our loans abroad, our debtors who can no longer borrow from us will have to pay us with gold, and that, irrespective of advances in foreign bank rates, fairly large quantities of gold will be received this year. The sequence of this prediction is that, if it comes true, the efforts of the Federal Reserve authorities to restrict credit will be greatly hampered, if not defeated, and this trend is one of the most important to watch during the coming months.

Industrial news is glowing. The automobile factories are turning out more cars each day than ever before in their history. The iron and steel mills are working as near capacity as they can get, and fresh price advances indicate that demand for steel is keeping up to the huge output. Reports from the tire factories show that they consumed more rubber in January than in any previous month on record.

It goes without saying that with such industrial records being made, there are no tales of unemployment such as were heard a year ago. Distributive trade is good, and car loadings and retail sales are running consistently above a year ago. The momentum of this business seems likely to carry on through March at any rate, and if the traditional effect of high money rates can be escaped, the commercial and industrial activity ought to endure until the usual summer decline. Although specific reasons are assigned for all these advances, it is equally plausible to believe that the yeast of inflation is at work in commodities.

The reparations experts appear to be making good progress, and most of the foreign news is as cheerful as could be expected, except for the blow that the higher Bank rate has dealt Great Britain. A similar advance here would probably deal at least the stock market a similar blow.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

DETROIT

There is every indication that February will far outstrip January in volume of machinery and machine tool sales here. Thus far several dealers have reported that their sales are far ahead of January, and at least one dealer made more sales in the first 20 days of February than in any month of last year. Many of the automobile companies are making large purchases of equipment, and all of them are buying something. One firm has reported the sale of five large diamond boring machines and has the expectation of placing several more within the near future.

The Fisher Body Company is buying equipment for its new die plant; Hudson, Studebaker, Buick, Oakland, Oldsmobile, Chevrolet and Briggs are all busy and active. Continental Motors is doing some buying as is Graham-Paige and a number of others. Most of the automobile plants are carrying out good sized programs of expansions and all of them are making plans for heavy production during the early part of the year at least.

Ford production has reached 7,000 cars a day. The Company is now moving men from its Highland Park plant which has been sold to the Briggs Manufacturing Company. It is likely that Briggs will be in the market for a large amount of equipment when it occupies its new plant. The small shops are busy although apparently not crowded. Employment is still going up.

One of the most interesting developments of the past week here is the announcement of the beginning of construction of a new $650,000 plant for the construction of the new Packard Diesel airplane engine. The Packard Motor Car Company, after a long and intensive period of experimentation and research, is now prepared to produce these oil burning engines on a large scale. It is expected that more than 500 engines a month will be produced by June. This will necessarily involve the purchase of a fairly large amount of machinery and equipment.

There are many aviation projects on foot here that will eventually mean a great deal to the machinery and machine tool trade.

MILWAUKEE

While the call for metal-working equipment is less feverish than it has been for two to three months, new business maintains the former volume, and there is excellent inquiry as well. It would appear that users of tools finally have come to realize the unusual situation that exists with respect to the ability to produce equipment, and are safeguarding themselves against delivery of orders when needed by anticipating these needs to a much greater extent that for some time past. In other words, the buyer is now inclined to give the maker a more reasonable period of time in which to build and ship tools.

Generally speaking, man-power is the predominant limitation on the industry. Makers of tools, as a rule, deem it futile to build shop additions to relieve the pressure, when they already are unable to man existing plants to the full limit of capacity. Then, too, there is apparent a certain degree of caution with respect to enlarging capacity that may become costly in leaner times.

A feature of business since the beginning of the year in this market is the demand for equipment by makers of highway construction and maintenance machinery. This applies particularly to those making snow plows for tractor and truck attachment.

There has been a tremendous demand for equipment to clear highways all through the northern states, due to record-breaking snowfall. Buying continues at a high rate, insuring a busy production period even during the usually quiet summer months. Manufacture of paving machinery likewise is proceeding on a scale never before known to cover orders for spring and summer delivery.

CLEVELAND

Opinions differ as to the actual condition in the local machine-tool business here. A few reports of slowing up are offset by those that report slight increases in sales. In general, however, it is acknowledged that inquiries are dropping off. Sales for the past ten days consisted mainly of one and two pieces to diversified lines.

The demand for used tools is above the average, the increased industrial activity has brought out unexpected buyers.

An official of a company making automatics states that its orders for the first three weeks of February aggregate as much as the entire month of January. An encouraging sign in this line is the more general distribution of tools. A month ago the automotive industry was buying ninety per cent of the tools, while at present time the influx of orders from other sources has diminished this to fifty per cent. Agricultural implement, electrical goods and general industrialists are buying more frequently. Demand for contractors equipment is becoming more active due to the extensive road building programs in contemplation. Contractors and various municipalities are preparing to ask for bids on road building equipment to replace worn and obsolete tools.

CINCINNATI

The majority of machine tool manufacturers of the Cincinnati district report that business held to a good level during the past week. A few had a slight increase in sales, and a few had a slight decrease. The trade, taken as a whole, held its own. All pronounce the month just closing a most satisfactory period, and the expectancy, based on general conditions and business pending, is that there will continue to be a good demand. Likewise, selling agents report that prospects developing in local and adjacent territory should result very soon in an increased volume of sales. However, one bad feature of the situation is the fear of a shortage of skilled labor with an increase in demand for machine tools and consequent necessity of increasing working forces.

The great majority of the orders booked in the past week were placed by general machinists and miscellaneous users, and called for single tools and replacements. These buyers were well scattered over the different sections of the country, and their requirements were well diversified as to sizes and types. Purchases made by automobile manufacturers and concerns in the allied trades were largely confined to single tools. One good-sized order was received from a Canadian steel concern.

Inquiries flowed in freely during the week from all sections of the country, the great majority of these being from general machinists and miscellaneous users. In most cases the requirements w re single tools and replacements, but here and there was an inquiry in regard to two or more pieces of equipment.

CHICAGO

The trend of business in machine tools thus far in February is slightly downward as compared with that of January. This does not apply to all lines of tool production, however, some concerns in midwest territory reporting that to keep approximately within sight of demand it is necessary to operate their plants night and day. Even when so doing deliveries are far behind in many lines, those of milling machines and automatic screw machines in particular.

There have been no lists of importance received during the last week, inquiry being largely limited to single tools and small lots. Agricultural machinery and tractor builders up to the present this year have given no intimation as to what their needs will be in the line of equipment for their plants; it is believed, however, that they will be heard from with substantial lists within a short time. For several weeks past there has been an unusually heavy demand for special sizes of small tools, with the result that manufacturers specializing in equipment of this type have been operating their plants to capacity. In wood-working machinery the output has fallen far below normal, according to all accounts. So great has been the recession in this line since last fall that a feeling akin to pessimism prevails among builders of and dealers in this class of machine tools. The slump is reported to be due to inactivity in the building and furniture industries.

BUFFALO

The machine tool and electrical equipment business along the Niagara frontier and throughout western New York continues to hold up well. Expansion in industries is widespread and varied in nature.

For example, in the aviation field the production plans of the Curtiss Aeroplane and Motor Company for the immediate future call for 109 "Fledgling" civilian training planes which will be used largely in the schools of the Curtiss Flying Service to be opened throughout the country within the next few months, 31 planes of the same type for the United States Navy, all equipped with its "Challenger" air-cooled motor. It is making 33 "Hawks" for the United States Army and 9 for Chili; 40 "Falcons" for the Army, 18 for Chili, and 9 for National Air Transport for the night air mail, all equipped with Curtiss-made motors. In addition it is working on an order of 1,000 "Challenger" radial-type, air-cooled motors.

In addition, the Consolidated Aircraft Corporation is pushing the commercial prototype of its flying boat, the XYP-1, which is now undergoing Navy tests. This commercial craft is intended for the Great Lakes and inland waterways traffic as well as coastwise. Its normal load will be 32 passengers, with complete toilet, sleeping and dining facilities. It is all metal except the wing coverings, with a wing span of 100 feet and an over-all length of 60 feet. The military type is powered with two motors, and has a cruising radius of 3,000 miles without refueling. The commercial type has three 430 horsepower motors. In addition this company is building its "Fleet" training plane in quantities, under contract.

The General Airplanes Corporation is in

production on several models, but some new developments are expected here soon. The Hall-Aluminum Aircraft Corporation also has a Navy contract for an experimental flying boat.

NEW ENGLAND

The New England market for machinery is active at a high level. In all quarters of the machine-tool industry the outlook is bright. Some builders and dealers reported the current week as the most active of the year. From a prospective standpoint this was also true with promising buying sources developing in new quarters.

The New Departure company with plants in three cities has started a program, which with new buildings and equipment combined will reach an expenditure in excess of $3,000,000. A list of automatic, forging, and special machinery is included; also three high-speed elevators, and handling and conveying machinery. All machines will be driven with individual motors.

The aeronautical industry is featuring New England business expansions. Plans are going forward for the manufacture of aircraft in the Rubwood Wheel plant at Monson, Mass. At Bridgeport, Conn., the Commercial Aircraft Corporation of America has announced a merger with the Stutz interests and will manufacture light planes and air-cooled motors designed by Harry C. Stutz. Motors will eventually be the entire output of the Bridgeport plant, while the planes will be made entirely at the Orlando, Florida, plant.

According to leading machine tool manufacturers the production of airplane motors does not equal the production of planes. In a short time this point will be reached and soon motors will be made at the rate of three motors for each two planes manufactured. With three motor planes in vogue and single planes likely to burn out as many as three motors before the discarding time arrives, this ratio must be increased. The machinery industry is anticipating an active future from this rapidly developing field.

PHILADELPHIA

While the feeling of optimism which has prevailed among leaders of the machinery and machine tool industry in this market for some months continues to prevail, the transactions during the last fortnight were marked with fewer orders than there were earlier in February and during the latter part of January.

There was some buying of machine shop equipment from industrial centers in the eastern section of the country, but mostly for replacements. The new equipment purchases which were noted two weeks ago were not apparent during the last two weeks, although the inquiries were numerous and were of a hopeful tone. Leaders of the industry reported that a normal condition prevails, and that the situation compares favorably with that which prevailed this time last year.

Machine and machine tool manufacturers are looking to the radio and airplane industry for some substantial orders. The recent activities in these lines indicate that modern equipment must soon be provided for shops in these lines. Some of the leaders of the respective industries look for early consolidations among both the radio and the airplane producers, which they say would result in placing the companies concerned on a more substantial basis. Public work in Philadelphia continues to progress. A $10,000,000 municipal subway project got under way last week with contracts having been awarded for another unit in the Broad Street subway.

NEW YORK

Only one dark spot seems to bother machinery dealers in the New York area, and that is the question of deliveries. Inquiries and orders are well distributed and are up to those of last month, but there is no stock of machine tools in the market and the best delivery promises from the manufacturers for standard machines seem to be from four to six weeks, and of more special machine tools from two to three months. Some dealers reported that it is even dangerous to anticipate too definitely the delivery promises of the manufacturers, as the latter are suffering from a dearth of skilled mechanics.

There are no unusual orders in prospect at the present time in the district, but inquiries continue to come in from all lines including some for fair amounts of equipment. There has been no let-up since the beginning of the year, and no signs of retrogression. In fact, one large dealer stated that if the volume of orders continued to grow, it would be impossible to handle them because of the inability to get quick deliveries. The speeding up of the manufacturing plants is reflected in demands for the new high-speed cutting alloys, the three New York concerns handling these products reporting large numbers of inquiries.

General conditions in the machinery business through the New York district can be quoted as very good. Modernization of plants of all sizes is likely to keep up the trend of machine and equipment inquiries, and from the dealer's standpoint the actual taking of orders will depend partly upon the ability of the builders to produce.

Business Items

The Commercial Aircraft Corporation of America, Bridgeport, Conn., has been merged with the Stutz interests, which operate a plant at Orlando, Fla. Officers of the new organization are: President, HARRY C. STUTZ; vice-president, FRANK BELLANCA; secretary and treasurer, JOSEPH CUBELLI. The company will complete the manufacture of the 16-passenger tri-motor sesquiplane designed by Bellanca and now under way, and will then manufacture small Bellanca plane equipped with air-cooled engines designed by Harry C. Stutz, who will be general manager as well as president of the company.

Arrangements for installation of machinery in the former National Lamp Co. building at Gray and Washington Sts., Indianapolis, Ind., by the P. R. Mallory Co., of Indiana, have been announced. This company, which expects to begin operation soon, will have approximately 875 employees at the start. It will include a large part of the manufacturing divisions of Elkon, Inc., Weehawken, N. J., and Knapp Electric Co., Port Chester, N. Y. Products will include "Carboloy" and "Elkonite," radio equipment, electro-mechanical toys, and fractional-horsepower motors.

Articles of incorporation have been filed in Indianapolis by the G. A. Schipper Co., Aurora, Ind. The corporation has an initial capital stock of 3,000 shares of no par value common and $20,000 of preferred. It is formed to manufacture and sell metal- and wood-working machinery, apparatus and supplies. The incorporators are GEORGE A. SCHIPPER, ERNEST W. SWARTHOUT, OBERST BURBANK, EVANS BURBANK, and JOHN L. SWARTHOUT.

The Prest-O-Lite Co., Inc., acquired the business of the Acetylene Products Co., on Jan. 1. The latter operated two acetylene producing plants, located respectively at Phoenix, Arizona, and El Paso, Texas. These plants are now being operated as units of the Prest-O-Lite chain. EVERETT R. KIRKLAND is superintendent of the Phoenix plant, and CARL F. CHESAK is superintendent of the El Paso plant.

The Universal Boring Machine Co., Hudson, Mass., has purchased a plant in that city from the General Electric Co., and has moved most of its manufacturing equipment into the new plant. The former General Electric Co. plant is much larger than the original Universal Boring Machine Co.'s plant.

In expectation of a record-breaking year for production of vacuum tubes, the Radio Corporation of America is enlarging and reorganizing its plant facilities at Bloomfield, N. J., Newark, and Cleveland. J. L. RAY, vice-president in charge of sales, predicted an increase in production of 150 per cent this year.

The Consolidated Instrument Co. of America, Inc., announces completion of arrangements for acquisition of the Aircraft Control Co., Philadelphia, manufacturer of apparatus for automatic steering and control of aircraft. This makes the third company acquired by the Consolidated Instrument Co. within the past three months.

The Packard Motor Car Co. announced plans for a $650,000 building to produce its new Diesel-type airplane engine. The building is to adjoin the present Packard plant. It will have a capacity of 500 engines a month. Engine delivery to airplane manufacturers will begin in June or July.

Articles of incorporation have been filed in Indianapolis by the B. F. Crawford Co., Terre Haute, Ind. The corporation has an initial capital stock of $20,000 and is formed to manufacture, buy, sell and otherwise deal in all kinds of machinery and industrial equipment. The incorporators are BENJAMIN F. CRAWFORD, DONALD M. CRAWFORD, and CARSON W. SIMMS.

Muskegon Motor Specialties has signed a contract with Marmon for the production of 10,000 camshafts in the first six months of 1929, in addition to the regular Marmon business. The company has also signed large contracts with Oldsmobile and Pierce-Arrow.

Ground was broken recently for the $10,000,000 plant of the A. M. Byers Co., at Ambridge, Pa., for the production of wrought iron by means of a new process. Work on the new plant, which will employ about 1,000 men, is expected to be completed within a year.

New financing of the Berliner-Joyce Aircraft Corporation is announced in the offering of a new issue of 50,000 shares of class A voting stock of no par value at $20 a share. The stock is noncallable, and is entitled to preference dividends of $1.50 a share.

The Saginaw Motor Equipment Co. and the Hawkes Auto Equipment Co., Lansing, have merged to form the General Distributing Co., located at Saginaw.

Personals

ADDISON MCGARRETT, formerly with the Niles Tool Works Co., of Hamilton, Ohio, is now with the Pratt & Whitney Co., Hartford, Conn., where he is manager of the new Agency Sales Department of the latter company. Mr. McGarrett has been with the Niles company more than 25 years, of which time he spent over 15 years traveling in New England, New York and Ohio, and 5 years as manager of the Rochester branch office which he established. ROBERT P. BRINKMAN, who assisted Mr. McGarrett at Hamilton, is with him at Hartford.

EDWARD MANHARD, vice-president Rock Island Bridge & Iron Works, Rock Island, Ill., has been elected president of the company, succeeding WALTER A. ROSENFIELD, who has been named chairman of the board. Mr. Manhard has been acting head of the company since Mr. Rosenfield's partial retirement six years ago. H. A. KNEISLEY has been elected vice-president; W. G. MURPHY, secretary, and M. S. CARLSON, treasurer.

THOMAS M. SMALL has been placed in charge of sales and service activities of the Colt's Patent Fire Arms Manufacturing Co., of Hartford, Conn., in the New York territory, including New Jersey, Philadelphia and Washington. He will handle the company's line of dish washers and metal cleaning machines. His office is at 20 Vesey St., New York. H. A. SIEFERMAN will take charge of sales in the Cleveland district, which includes Buffalo and Rochester.

JAMES A. MUIR, until recently sales engineer for the Thomson Electric Welding Co., has been appointed assistant to the president, A. C. TAYLOR, of the Taylor-Winfield Corporation, Warren, Ohio. He will have charge of customer contacts through the various service and sales offices located throughout the country. This appointment will permit Mr. Taylor to devote his entire time to the design and perfection of welders, the company's product.

W. H. EDDY, formerly chief inspector, has been made general superintendent of the Oakland Motor Car Co., taking the place of R. B. SMITH, who has been assigned to the study of manufacturing problems; VERN E. WALTERS succeeds W. H. VANN as master mechanic. Mr. Vann will become chief inspector when he returns from a sick leave. L. A. BLACKBURN has been made superintendent of non-productive departments.

ALBERT F. CORBIN, president of the Union Manufacturing Co., New Britain, Conn., for 21 years, has resigned and the board has elected Carl S. Neumann, formerly secretary, to succeed him. Mr. Corbin was once secretary of the Corbin Cabinet Lock Co., and became connected with the Union Manufacturing Co. in 1905. In 1908 he was elected president to succeed his brother, the late GEORGE C. CORBIN.

PIERCE J. MAUCK, superintendent of production at the Cleveland plant of the Fisher Body Co., is now manufacturing engineer for the 40 Fisher plants in the United States and Canada. His headquarters will be at Detroit. At Cleveland he is succeeded by ANDREW G. CAMPBELL, formerly superintendent of the body shop and mill.

KARL HERMANN, consulting engineer for the Studebaker Corporation since 1927, has bought the controlling interest in the Bantam Ball Bearing Co., of Indiana and Connecticut, and will consolidate immediately all the assets and operations of both companies in South Bend.

E. H. WOOD, 220 Delaware Ave., Buffalo, N. Y., and CHAS E. DAVIS, 888 the Arcade, Cleveland, have been appointed representatives in their respective districts for the stamping, forming and pressed metal contract department of the Geuder, Paeschke & Frey Co., of Milwaukee, Wis.

E. T. CAUSER, formerly president of Atlas Manufacturing Co., Fostoria, Ohio, and works manager of Chandler Motors Corporation, Cleveland, has been appointed general manager of the crankshaft division of the Union Drawn Steel Co., of Beaver Falls, Pa.

HAYDEN HODGES has been elected a director of the Chicago Electric Mfg. Co., to succeed HAROLD T. AMES, resigned, and HOWARD H. OETJEN has been elected vice-president in place of R. E. MOORE, resigned

COMMANDER DARDELET of the French Army is now in the United States to co-operate with the Dardelet Threadlock Corporation, 120 Broadway, New York City, in introducing the self-locking thread that bears his name.

FRANK S. O'NEIL, plant manager in Indianapolis of the Link-Belt Co., has been elected president of the Indianapolis Foundrymen's Association. He succeeds T. J. CORNWELL of the Peerless Foundry Company.

A. S. ROGERS, president of the White Sewing Machine Corp., Cleveland, has been elected a member of the board of directors of the American Multigraph Co., Cleveland.

JOHN J. FINDLATER, for seven years field superintendent of the River Rouge plant of the Ford Motor Co., has resigned. He was identified with the company for more than eighteen years.

FRANK T. BUMBAUGH has been elected president of the Monessen Foundry & Machine Co., Monessen, Pa., to succeed the late W. S. BUMBAUGH.

JOHN VAN NOSTRAND was elected president for 1929 of the Engineer's Club of Toronto.

HARVEY R. BUCKNER has been appointed works manager of the Jordan Motor Car Co., Cleveland, Ohio.

Obituaries

HUGO ANDERSON, one of the founders of the Anderson Bros. Manufacturing Co., Rockford, Ill., of which he was treasurer, died February 16, after a long illness. He was born Sept. 14, 1884, in Sweden, his parents coming to Rockford when he was a child. His demise leaves two brothers, Swan and Axel, associated in the business. He was 44 years old.

WALTER D. UPTEGRAFF, for fifty years associated with the Westinghouse Air Brake Co., Pittsburgh, and at the time of his death, president of the Defiance Paper Co., Niagara Wall Paper Co., and the Pittsburgh Wall Paper Co., died February 18 after a brief illness. Mr. Uptegraff was 64 years old.

G. F. HONOLD, president of the Globe Mfg. Co., Sheboygan, Wis., manufacturer of metal stampings, died suddenly at the Hotel McAlpin, New York, on Feb. 12, of heart disease. He was on a business trip. He was 57 years old.

WILLIAM W. PENFIELD, president and treasurer of William W. Penfield, Inc., Stamford, Conn., manufacturer of metal goods, died after a long illness. He was 67 years old.

Forthcoming Meetings

AMERICAN MANAGEMENT ASSOCIATION. Production Executives' conference, Feb. 27-28 and Mar. 1, at the William Penn Hotel, Pittsburgh, Pa. Oscar Grothe, vice-president in charge of the production executives' division, c/o White Sewing Machine Co., Cleveland, Ohio.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting in Knoxville, Tenn., March 21-22. Eastern spring meeting in Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL METAL TRADES ASSOCIATION. Convention, Hotel Drake, Chicago, April 24-25. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

AMERICAN WELDING SOCIETY. Annual meeting, April 24-26, at the Engineering Societies Bldg., New York. M. M. Kelly, secretary, 29 West 39th St., New York.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

The Weekly Price Guide

Rise and Fall of the Market

TWELVE price advances occurred during the week in the materials listed here, as compared with two declines. The increases affected the following items: blue-annealed and galvanized sheets, Pittsburgh, 10c. per 100 lb.; black sheets, Pittsburgh, 15c. per 100 lb.; copper, New York, 1c. per lb.; lead, East St. Louis, 0.1c. per lb.; solder, New York, ½c. per lb.; zinc sheets, Cleveland, 0.7c. per lb.; babbitt metal, New York, 2c. per lb.; linseed oil, 0.2c. at New York and 0.4c. per lb. in Chicago; scrap copper and lead at New York and scrap brass and copper in Cleveland. The declines were as follows: tin, ½c. per lb., New York; antimony, ½c. per lb., Cleveland. Hot-rolled bars, shapes and plates are selling at $1.90 per 100 lb., Pittsburgh, in large mill lots. A price of $1.95, however, is asked by leading makers on second quarter requirements.

(*All prices as of Feb. 23, 1929*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.80@2.90	3.60	3.40	3.80
No. 22	2.95@3.05	3.75	3.55	3.95
No. 24	3.00@3.10	3.80	3.60	4.00
No. 26	3.10@3.20	3.90	3.70	4.10
No. 28	3.25@3.35	4.50	3.85	4.25
Galvanized				
No. 10	2.80@2.90	3.95	3.75	4.05
Nos. 12 to 14	2.90@3.00	4.05	3.85	4.15
No. 16	3.00@3.10	4.15	3.95	4.25
No. 18	3.15@3.25	4.30	4.10	4.40
No. 20	3.30@3.40	4.45	4.30	4.55
No. 22	3.35@3.45	4.50	4.35	4.60
No. 24	3.60@3.70	4.65	4.45	4.75
No. 16	3.75@3.85	4.90	4.70	5.00
No. 28	4.00@4.10	5.15	4.95	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches—½	¾	¾	⅞	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$9.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †250 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.00
Tin, Straits, pigs, New York			53.00
Lead, pigs, E. St. Louis	6.85	New York	8.00
Zinc, slabs, E. St. Louis	6.35	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	13.00	12.50	14.25
Copper sheets, base	27.37½	27.37½	27.37½
Copper wire, base	23.37½	23.62½	19.87½*
Copper bars, base	25.87½	25.87½	26.37½
Copper tubing, base	28.37½	28.37½	28.37½
Brass sheets, high, base	22.50	22.50	22.50
Brass tubing, high, base	27.37½	27.37½	27.37½
Brass rods, high, base	20.25	20.25	20.25
Brass wire, high, base	23.00	23.00	23.00

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.70	10.11
Solder (½ and ½).....	35.00	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			69.00
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	16.00 @16.25	15.25	14.75 @15.25
Copper, heavy, and wire..	15.00 @16.00	14.75	14.12½@14.50
Copper, light, and bottoms	13.50 @14.00	12.50	12.75 @13.25
Heavy lead.....	5.50 @ 5.75	6.25	5.00 @ 5.50
Tea lead.....	4.00 @ 4.37½	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	9.00 @ 9.25	10.00	9.25 @ 9.75
Brass, heavy, red.....	....	12.75	12.00 @12.50
Brass, light.....	7.50 @ 8.00	8.25	8.25 @ 8.75
No. 1 yellow rod turnings	10.00 @10.50	10.50	9.75 @10.25
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16@.16½	38.00 per M	.16
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.11	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.30	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales or less.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0324
Cold drawn shafting...	per lb..	.35	.345	.033
Brass rods.....	per lb..	.2025	.19	.165
Solder (½ and ½).....	per lb..	.35	.345	.3425
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.59	3.59	3.10
Lard cutting oil.....	per gal.	.65	.65	.65
Machine oil.....	per gal.	.30	.30	.27
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.05	$4.29	$4.29
Emery cloth.....	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.04	2.04	2.04
Cloth.....	3.59	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@2.85
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.25
Red lead, dry.....	100 lb. kegs....	New York,	13.25
Red lead, in oil.....	100 lb. kegs....	New York,	14.75

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston — B. L. Smith, 44 Bromfield St.—9 in. swing screw cutting bench lathe.

Mass., Boston — Summerfield Co., 727 Washington St.—planer and finisher, jig saw and spindle and drum sander.

Mass., Reading — Box 96—16 in hollow spindle lathe, bench drill press, small shaper and miller.

Mass., Wakefield—Neveroil Bearing Co. —short bed production lathe, Porter, Cable or Sundstrom type.

Mich., Detroit—Detroit Lead Pipe Works, 600 West Larned St. — machinery and equipment for the manufacture of lead pipe for proposed 1 story lead pipe factory on Livernois Ave. Estimated cost $75,000.

Mich., Detroit — Enterprise Tool Corp., 1590 East Philadelphia Ave. — grinding machine.

Mich., Detroit—H. R. Krueger & Co., 439 East Fort St.—(toolmakers) boring and milling machine.

O., Akron—G. W. Sherman, Post Office Box 603—one 8 in. pipe bending machine, motor driven.

O., Cleveland—Cleveland Tool & Die Co., 2415 West 25th St., J. Tormaesky—one medium sized punch press.

Texas and Arkansas — St. Louis Southwestern Ry. Co., St. Louis, Mo., H. G. Devine, Asst. Purch. Officer—new tools and equipment to cost $300,000 for shops in Tyler, Tex., and Pine Bluff, Ark.

Ont., London—General Steel Wares Ltd., 489 Richmond St., J. M. Moore—complete electrical equipment for the manufacture of enamelware for oven house. Estimated cost $50,000.

Opportunities for Future Business

Calif., Long Beach—Ford Motor Car Co., 1004 Marquette Bldg., Detroit, Mich., is receiving bids for the construction of a 315 x 920 ft. assembly plant, warehouse, etc., here. A. Kahn, Inc., 1000 Marquette Bldg., Detroit, Mich., Archt.

Calif., Los Angeles—Bd. Education will soon award contract for Belvedere junior high school, including 60 x 140 ft. shop building, etc. E. H. Cline, Petroleum Securities Bldg., Archt. Noted Feb. 21.

Calif., Sacramento — Watsonized Industries, Inc., 962 Stanford St., Oakland, is having plans prepared for the construction of a 3 story factory here. Estimated cost $120,000 including equipment. N. H. Bateman, 609 Miguel St., Sacramento, Archt.

Conn., Bridgeport—Blue Ribbon Service Inc., 554 Fairfield Ave., awarded contract for a 1 story, 30 x 140 and 30 x 50 ft. brake testing and auto sales vulcanizing building on John St. Estimated cost $50,000. Noted Jan. 31.

Conn., Hartford—J. C. Barrett Co., 516 Asylum St., manufacturers of aluminum plate, is having plans prepared for a 2 story, 40 x 100 ft. factory on Elmwood St. Estimated cost $40,000.

Conn., New London—U. S. Coast Guard Academy, Monegan Ave., plans the construction of an academy including shop, etc. Estimated cost $1,750,000. Private plans.

Ill., Chicago—Johnson & Meier Co., 646 North Michigan Ave., manufacturers of ornamental wrought iron furnishings and fixtures, plans the construction of a 2 story factory at 919 to 929 West North St. Estimated cost $35,000. H. E. Gallup, 649 North Michigan Ave., Archts.

Ill., Chicago—Nordendale Mfg. Co., 1638 North Paulina St., manufacturers of metal stampings, plans the construction of a 2 story, 48 x 125 ft. factory at Hoyne Ave. and Fulton St. Estimated cost $30,000. Architect not selected.

Ill., Chicago—Triner Scale & Mfg. Co., 2714 West 21st St., manufacturers of scales, plans the construction of a 4 story, 125 x 145 ft. factory at 21st St. and Fairfield Ave. Dyer & Nadherny, 38 South Dearborn St., Archts.

Indiana — Chesapeake & Ohio Ry. Co., Richmond, Va., plans additions to railway shops at Peru, also new yards, etc. at Richmond. Estimated cost $150,000 and $125,000 respectively.

Ind., Anderson—C. A. Martindale, 817 Jackson St., is receiving bids for a 1 story, 75 x 180 ft. machine shop and garage on North Main St. Estimated cost $40,000. Private plans.

Ind., Evansville—W. Sanderson, c/o H. E. Boyle, 405 Furniture Bldg., Archt., will soon award contract for a 6 story, 96 x 225 ft. garage. Estimated cost $150,000.

Ind., Fort Wayne — John Deere Tractor Co. awarded contract for a 4 story, 100 x 100 ft. factory. Estimated cost $150,000. Noted Nov. 15.

Kansas — Quartermaster, War Dept., Washington, D. C., is having preliminary plans prepared for completion of field shop, hangar and headquarters buildings at Leavenworth and Marshall Field, Fort Riley. Estimated total cost $140,000.

Me., Lewiston—American Electric Metal Corp., I. P. Schwarzkopf, will soon award contract for a 1 story, 110 x 130 ft. plant and laboratory. Estimated cost $65,000. Lockwood Greene & Co., 24 Federal St., Boston, Mass., Engrs.

Md., Baltimore—Berliner-Joyce Aircraft Corp., Heart Tower, will soon award contract for a 1 story, 140 x 240 ft. aeroplane factory. Estimated cost $250,000. Kubitz & Koenig, Emerson Tower, Archts. and Engrs. Noted Feb. 14.

Mass., Cambridge (Boston P. O.)—North Cambridge Community Church, S. Weens, 28 Hubbard Ave., is having preliminary sketches made for the construction of a church including vocational shop, etc., at North Cambridge. Forham, Robb & Little, 140 Boylston St., Boston, Archts.

Mass., Springfield—Spartan Saw Works, 152 Fish Ave., is having preliminary plans prepared for the construction of a plant. Estimated cost to exceed $40,000. P. B. Johnson, 1562 Main St., Archt.

Mich., Dearborn — Ford Motor Co. awarded contract for a 1 story, 60 x 320 ft. addition to automobile factory. Giffels & Vallet, 604 Marquette Bldg., Detroit, Engrs.

Mich., Detroit—Hupp Motor Car Corp., 3641 East Milwaukee St., awarded contract for a 1 story, 40 x 500 ft. addition to stamping plant. Estimated cost $150,000.

Mich., Flint — Crane Co., 836 South Michigan Blvd., Chicago, Ill., awarded contract for a 1 story, 105 x 105 ft. building for pipe shop and warehouse. Estimated cost $50,000.

N. H., Laconia—Scott & Williams Inc., 299 Union Ave., manufacturers of knitting machinery, is having preliminary sketches made for additions and alterations to plant. Estimated cost $150,000. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

N. H., Manchester—H. E. Hartman, 11 Prospect St., is having plans prepared for a 2 story, 110 x 170 ft. repair and service garage on Elm St. Estimated cost $60,000. A. W. Osberg, 508 Manchester St., Archt.

N. J., Camden—Rundle Mfg. Co., 27th St. and Cleveland Ave., Milwaukee, Wis., plans the construction of a 150 x 322 ft. foundry, shops, etc. on River Rd. here. Estimated cost $1,000,000.

N. J., Linden—Standard Oil Co. of New Jersey, Brunswick Ave., awarded contract for a 3 story, 45 x 145 ft. general engineering building at Bayway. Estimated cost $150,000.

N. J., Perth Amboy — Standard Underground Cable Co., 26 Washington St., is having plans prepared for a 1 story cable manufacturing plant. Estimated cost $200,000. Private plans. Noted Feb. 21.

N. Y., Astoria — S. Norman, 1064 East 7th St., Brooklyn, plans the construction of a 1 story, 92 x 125 ft. garage at 15th and Astoria Aves. Estimated cost $40,000. Farber & Kulkin, 1746 Pitkin Ave., Archts.

N. Y., Brooklyn — A. Gobel, Inc., 34 Rock St., plans the construction of a 3 story addition to garage and shop at Thames St. and West Morgan Ave. Allmendinger & Schlendorf, 852 Monroe Ave., Archts.

N. Y., Brooklyn—H. B. Levy, 1205 Eastern Parkway, plans the construction of a 2 story, 80 x 100 ft. garage at Utica Ave. and Rutland Rd. Estimated cost $45,000. Architects Studios, Inc., 858 East 51st St., Archt.

N. Y., Brooklyn — Nostrand Holding Corp., M. Glengosh, Pres., 32 Court St., plans the construction of a 2 story, 95 x 115 ft. garage at New York and Schenectady Aves. Estimated cost $80,000. M. Klein, 65 Court St., Archt.

N. Y., Brooklyn—I. Polivnick, 26 Court St., plans a 1 story, 90 x 107 ft. garage at Dean St. and Boerum Pl. Estimated cost $60,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—Savino Holding Corp., 878 East 43rd St., plans a 2 story garage at Glenwood Rd. and East 42nd St. Estimated cost $60,000. T. M. Cannella, 1139 St. Marks Ave., Archt.

N. Y., Elmhurst — M. Pomerantz, 7913 Pulaski St., Middle Village, plans a 2 story, 97 x 164 ft. garage at 79th St. and 46th Ave., here. Estimated cost $60,000. M. Perlstein, Middle Village, Archt.

N. Y., Flushing — W. A. Walsh & Co., Bank of Manhattan Bldg., Long Island City, plans the construction of a 1 story, 100 x 200 ft. garage, etc., at Dahlia Ave. and Jaggar St. Estimated cost $70,000. A. H. Eccles, Chatham-Phoenix Bldg., Long Island City, Archt.

O., Cleveland—Carnegie Body & Top Co., E. S. Eckstin, Secy. and Treas., 6115 Carnegie Ave., had plans prepared for a 1 story, 97 x 155 ft. shop. Estimated cost $50,000. J. F. Steffens, Fidelity Bldg., Archt.

O., Cleveland—Cleveland Worm & Gear Co., H. Dingle, Pres., 3249 East 80th St., awarded contract for a 1 story, 30 x 100 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Ohio Electric & Controller Co., 5900 Maurice Ave., awarded contract for a 3 story, 38 x 80 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Otis Steel Co., J. S. Campbell, 3341 Jennings Rd., will build a 1 story, 75 x 199 ft. addition to shop and warehouse. Estimated cost $50,000. Private plans.

Va., Richmond—Victory Products Corp., R. J. Funkhauser, Pres., Hagerstown, Md., have acquired two Winchester manufacturing plants here, and plans extensions and improvements for the manufacture of wood novelties, cold storage doors and other products. Sure Foot Heel & Rubber Co., Gettysburg, Pa., and Victor Cooler Door Co., Hagerstown, Md., are interested.

Wash., South Bend—M. J. Owens plans the construction of a sawmill at north bank of Willapa River between South Bend and Raymond.

Sask., Melville—Canadian National Railways, Montreal, Que., plans the construction of shops, etc., here. Estimated cost $250,000. C. S. Gzowski, Ch. Engr.

Ont., Toronto—Canadian General Electric Co., 212 King St. W., awarded contract for a 1 story, 50 x 100 ft. addition to electrical plant on Ward St. Estimated cost $50,000.